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Chronology And Sequence Of Eruption Of Deciduous Teeth In Children Of Rajnandgaon, Chhattisgarh.

Dr.Dimple Tirale [1], Dr. Nagarathna PJ [2] and Dr. Keyura Parakh[3,*]
[1]Chhattisgarh dental college and research institute (Rajnandgaon),dimpletirale310@gmail.com
[2]Chhattisgarh dental college and research institute(Rajnandgaon),drsiddu4@gmail.com
[3];Chhattisgarh dental college and research institute (Rajnandgaon), keyuraparakh@gmail.com
*Correspondence: drsiddu4@gmail.com ; Tel.:9986889525

Abstract: There has been a wide variation in the time and sequence of primary teeth emergence among different population, ethnic and racial groups. The present study conducted to determine the chronology of eruption of deciduous teeth in children of Rajnandgaon, Chhattisgarh. A Prospective observational cohort study with sample of 408 chhattisgarhi children aged between 0-48 months was selected by simple random sampling method. Other variables such as type of delivery, weight, height, type of feeding pattern, duration of feeding, type of milk products used, use of teething syrups and number of teeth erupted were recorded. Clinical examination was done under natural illumination. It was found that mandibular central incisor was the first tooth to erupt at 10.15 -10.42 months followed by maxillary central incisor at 11.4 months showing the mean difference of 4 months. Eruption of primary tooth is delayed as compared to standard eruption chart among Chhattisgarh children. Significant difference was found for the type of feeding and duration of feeding for the children with p=0.04 and 0.01 respectively in regression analysis. This study also justify that the environmental and systemic factors has shown influence on eruptive process.

Keywords: chronology, eruption sequence, eruption timing

Introduction

Eruption is a continuous physiologic process where tooth appear in the oral cavity through gingival to contact opposing arch. The term “eruption” is derived from the Latin word “erupptione,” which means output with momentum.[1] Eruption of deciduous teeth is an orderly, sequential and age specific event.

While both, primary and permanent tooth emergence have been studied in many human populations, important various issues surrounding biological milestones remain unsolved for example ‘age’.[4] Several studies have shown variations in individual primary tooth eruption amongst various age group, [3,5] as well as variations in the factors that may likely affect the time and sequence of primary teeth emergence.

The process of eruption of primary teeth has been of great interest to investigators and parents as it acts as biomarkers in development of facial esthetics, mastication and speech. Significant deviations from accepted norms of eruption time like premature eruption and delayed tooth eruption are the most commonly encountered deviation. There are various factors which influence the tooth eruption such as malnutrition, genetics, gestational period etc. The timing and sequence of deciduous teeth eruption differ to some extent between populations and geographical areas.

Evidence based, result oriented information regarding timing, sequence and pattern of emergence of primary teeth are needed to be established for correct diagnosis and treatment planning, caries prevention, protection of first molars during the caries susceptible period, cosmetic purpose and also for anthropological use. While eruption chronology of the primary dentition has been studied in some populations, only a few studies from India and other African

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countries have been reported [6]. Thus, it is important to undertake this type of study in India to determine the appropriate reference standard for eruption of primary teeth in Indian children. Keeping this in mind, the present study was contemplated with the purpose of evaluating the eruption time of deciduous teeth among children of Rajnandgaon city, Chhattisgarh State (India) compared to the standard data and evaluation of factors influencing the eruption of deciduous teeth.

Materials and method

Type of study- Prospective observational cohort study

Source of Data

Children aged 0 - 48 months were selected by simple random sampling from health centres and aanganwadis of Rajnandgaon (Chhattisgarh, India) where children from various socioeconomic strata will be present. Ethical Clearance was obtained from the Institutional Ethical Committee. Informed written consent was obtained from parent. Infant and children were subjected to full medical examination and only healthy normal subjects were included in the study sample following inclusion and exclusion criteria. All children were given a dental examination where a total of 408 Chhattisgarhi infants (215 girls & 193 boys) were examined. These children were followed up for a period of one year during the development of dentition. Full term healthy babies (weight ≥ 2500 grams) who are born and brought up in Rajnandgaon, Chhattisgarh and their parents being the domicile of Chhattisgarh were included and children who have preterm birth and history of developmental disorder or with any severe medical illness were excluded. Children from the age of 0 to 48 months were screened and distributed into age groups as follows:

Group I: 0 to 12 months of age (0-1year)
Group II: 13 to 24 months of age (1-2 years)
Group III: 25 to 36 months of age (2-3 years)
Group IV: 37 to 48 months of age (3-4 years)

A thorough history was obtained on a specially designed proforma which includes name, age, gender, date of birth, address, parents education, parents contact number, socioeconomic status, type of delivery, weight and height of patient, type of feeding pattern, duration of feeding, type of milk products used and use of teething syrups. These factors were included in the study.

Clinical examination

The teeth examined was considered as erupted when any part of it had penetrated the gum which could be seen and touched. The number of teeth already erupted were recorded on the proforma. The dental records were made monthly. Dental charts were made according to universally accepted Federation Dentaire Internationale (FDI)standards. Clinical examination of the subject was done by visual inspection of the oral cavity under natural illumination using mouth mirror. Statistical analysis was done using SPSS version 17.5software. Association between categorical variables was assessed using Pearson coefficient of correlation and regression analysis.

RESULTS

A total of 408 children aged 0 to 48 months were included in the study who were further grouped into 4, out of which group I and IV consisted of 101 children, group II and III had 103 children. There were 55 males and 46 females in group I, in group II, 51were males and 52 were females, whereas group III 47 were males and 56 were females and group IV 40 males and 61 females. (Table 1)

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Table no. 1: Distribution of males and females according to respective age groups

Age groups(yrs)	Male	Female	Total
0-1	55	46	101
1-2	51	52	103
2-3	47	56	103
3-4	40	61	101
Total	193	215	408

In our study we reported the combined mean age of eruption of deciduous teeth between male and female in each group where,

Group I: 0 to 12 months of age

The first tooth to erupt was mandibular left central incisor at 10.15 ± 0.67months followed by right side at 10.42 ± 0.48 months followed by which maxillary central incisors erupted at 11.4 ± 1.07 months. Mandibular left and right lateral incisors erupted at 13.21 and 13.32 ± 0.04 months respectively followed by maxillary right and left side at 14.14 ± 0.33 and 14.15 months respectively. Maxillary left first molar erupted early at 18.46 ± 0.53 months than right side at 18.57 months followed by which mandibular left and right first molars erupted at 19.09 ± 0.38 and 19.13 ± 0.35 months respectively. Last teeth in this group was maxillary canines at 22.03 ± 0.26 months.

Group II: 13 to 24 months of age

The teeth erupted during this age group are lateral incisor, canine, first and second molar. At 14.5± 2.12 months right maxillary lateral incisor erupted followed by mandibular lateral incisors at 14.73 ± 0.85 months then at 18.33 ± 1.14 months left maxillary lateral incisor erupted. After lateral incisors left maxillary first molar began to erupt at 18.45 months followed by left and right mandibular first molars at 18.51 ± 0.59 and 18.59 ± 0.68 months respectively. Right Maxillary first molar was the last to erupt at 18.97 ± 0.17 months of age. Right maxillary and mandibular canines erupted earlier at 24.34 ± 0.26 and 19.34 ± 7.18 months than left side at 24.45 ± 0.13 and 24.35 ± 0.16 months respectively.

Group III: 25 to 36 months of age

In this group, canines and second molars were seen to be erupting. Maxillary canine erupted earlier than mandibular at 24 and 24.5 ± 0.71 months respectively while mandibular second molars erupt earlier than maxillary at 29 and 30 months respectively.(Table:3)

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Table no. 3: Combined Mean age and Standard deviation of eruption of Mandibular teeth in boys and girls

Tooth number	**0-1 yr**	**1-2 yrs**	**2-3 yrs**	**3-4 yrs**
71	10.15±0.67	14.13±0	33±0	
72	13.21±0.01	14.87±0.94	36±0	
73		24.35±0.16	24.5±0.71	
74	19.09±0.38	18.51±0.59		
75		29.43±0.06	29.32±0.32	
81	10.42±0.48		33±0	
82	13.32±0.04	14.73±0.85	36±0	
83		19.34±7.18	24.5±0.71	
84	19.13±0.35	18.59±0.68		
85		29.54±0.04	29.27±0.37	

Group IV: 37 to 48 months of age

This group showed only eruption of maxillary second molars of right side at 36.38 ± 0.17 months and left side 36.5 months.(Table 2)

Table no. 2: Combined Mean age and Standard deviation of eruption of Maxillary teeth in boys and girls

Tooth number	**0-1 yr**	**1-2 yrs**	**2-3 yrs**	**3-4 yrs**
51	11.4±1.07		33±0	
52	14.14±0.33	14.5±2.12	36±0	
53	22.03±0.26	24.34±0.26	24±0	
54	18.57±0.41	18.97±0.17		
55		31.05±0.19	30.74±0.23	36.38±0.17
61	11.4±0.01		33±0	
62	14.15±0.38	18.33±1.14	36±0	
63	22.03±0.25	24.45±0.13	24±0	
64	18.46±0.53	18.45±0		
65		30.93±0.23	30.56±0.02	36.5±0

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In the present study, the eruption sequence based on the data of mean age of eruption when compared with the eruption sequence of standard data (Fig. 1) is as follows, mandibular central incisor was the first tooth to erupt at 10.42 ± 0.48 months followed by maxillary central incisor at 11.4 ± 1.07 months.

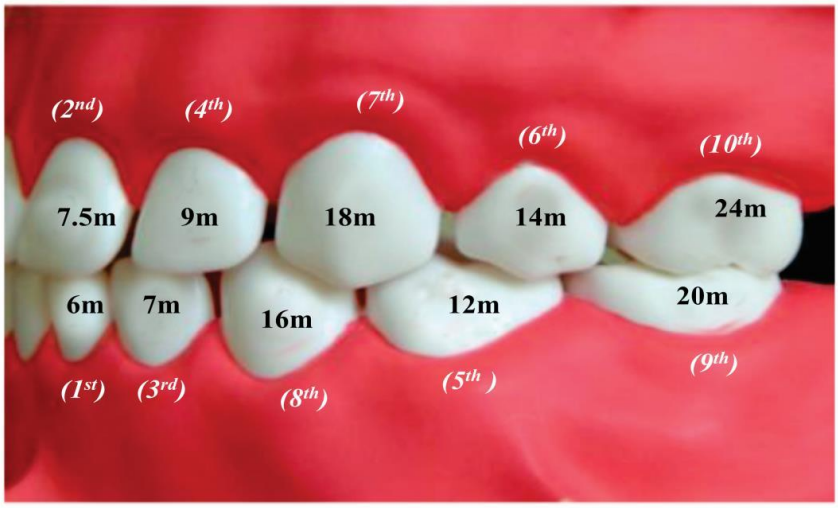

Fig 1: Order of teeth eruption (within brackets) & age of eruption of deciduous teeth (in months 'm') according to standard data.[7]

Similarly mandibular lateral incisor erupted followed by maxillary lateral incisor at 13.32 ±0.04 and 14.14 ± 0.33 months respectively. Mandibular and maxillary 1st molar erupted at 18.59 ± 0.68 months and 18.97 ± 0.17 months respectively. Maxillary canine erupted earlier at 24±0 months then mandibular canine at 24.5 ± 0.71 months. Similar to the standard data second molars were last teeth to erupt, i.e mandibular at 29.27 ± 0.37 months and maxillary at 36.38 ± 0.17 months. Since there was no significant difference between the right and left quadrant, the data of right side was considered. Here the eruption of deciduous teeth is described in four groups- group I (incisor eruption), group II (first molar), group III (canine eruption), group IV (second molar). The sequence of eruption of deciduous teeth was mandibular central incisor, maxillary central incisor, mandibular lateral incisor, maxillary lateral incisor, Mandibular 1st molar, maxillary 1st molar, Maxillary canine, mandibular canine, mandibular second molar, and maxillary second molar.(Fig:2)

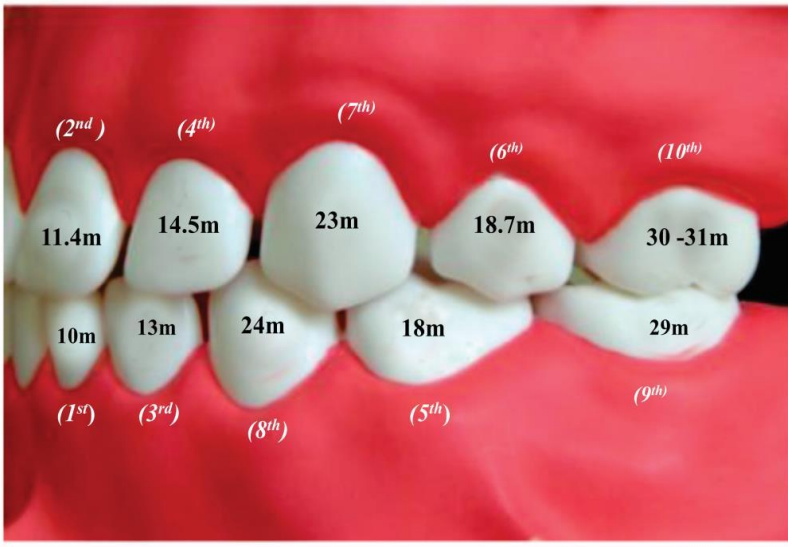

Fig 2: Order of teeth eruption (within brackets) & age of eruption of deciduous teeth(in months 'm') as per the finding of our study.

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Variable factor of socioeconomic status belongs to 1-5lakhs/annum group ($p<0.05$) and most of the parents were graduates ($p=0.002$) (Table: 4)

The type of delivery and child number did not show significant difference. There was remarkable increase in the height and weight of the children with age. Feeding pattern, duration of feeding and type of milk product used for children showed a significant difference with p value of 0.04 (Table: 4)

Regression analysis was made between the variables and the mean age of eruption of first tooth to determine the effect of the factors. Beta coefficient for each variables showed positive effect on the eruption of teeth as in the values for each variable increases there is increase in the duration of eruption of teeth. There was a significant difference found for the feeding type and duration of feeding for the children with the p value of 0.04 and 0.01 respectively (Table no. 4)

Table no. 4: Multiple regression analysis between variables and first tooth eruption

Variable		Beta coefficient	SE	95% CI		R^2	P-value
				Upper	Lower		
Gender	Male	0.0647	0.451	0.741	0.247	0.021	0.32*
	Female	-	-	-	-		
Weight		0.572	0.171	2.018	0.174	0.06	0.089*
Height		0.0225	0.240	0.641	0.127	0.028	0.258*
Feeding type	Breast feed	-	-	-	-	0.05	0.049**
	Bottle feed	-	-	-	-		
	Both	0.472	1.018	-1.018	0.074		
Duration	1yr	-	-	-	-	0.0002	0.010**
	2yrs	-	-	-	-		
	> 2 yrs	0.23	0.138	0.047	0.507		
Milk product	Cerelac	-	-	-	-	0.566	0.289*
	Dexolac	0.057	0.640	1.641	0.827		
SES	< 1 lakh	-	-	-	-	0.882	0.402*
	1-5 lakhs	-	-	-	-		
	6-10 lakhs	0.075	0.840	0.801	0.327		
Parents education	Illiterate	-	-	-	-	0.86	0.09*
	Ssc/hsc	-	-	-	-		
	Graduate	-	-	-	-		
	Post graduate	0.702	8.018	2.016	1.274		
Delivery type	Caesarian	-	-	-	-	0.97	0.07*
	Normal	0.892	0.702	-9.018	4.074		
Child number	First	-	-	-	-	0.040	0.239*
	Second	-	-	-	-		
	Third	0.428	9.18	2.018	1.004		

*p-value>0.05 is insignificant; **p-value<0.05 is significant

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Discussion

The eruption sequence and growth of the jaws are key elements in the development of functional and esthetic occlusions. As far as deciduous teeth eruption ages are concerned, they were obtained based on children's age, according to the eruption of each type of tooth compared with standard data based on western population by Logan and Kronfeld. [7]

The formation of teeth, development of dentition and growth of craniofacial complex are closely related. [8]Tooth emergence has not been investigated in Chhattisgarhi population & information on eruption age of deciduous teeth used in clinical and academic situation here is based on other populations like Caucasians [5,9]. It has been suggested in the literature that standards for tooth emergence should be derived from the population in which they are to be applied because factors related to deciduous and permanent dentition may vary.[10]

A Prospective observational cohort study was designed on Chhattisgarh population of Rajnandgaon. A total of 500-600 children aged 0-48 months were screened at randomly selected health centres and aanganwadis of Rajnandgaon (Chhattisgarh, India). These children were divided into four groups such as group I- 0-1year, group II- 1-2 years, group III- 2-3 years and group IV 3-4 years to determine the mean age of deciduous teeth eruption.

In this study delayed eruption of deciduous teeth was present in Chhattisgarh children when compared to their counterparts in other populations in India [11, 12]. Most of the teeth showed a more than four months variation as compared to standard data. The order of eruption was different as compared to standard data [7] in the incisor teeth eruption. Maxillary central incisor was the second teeth to erupt not mandibular lateral incisor then maxillary and mandibular canines were found reverse in sequence as compared to standard data which was similar in Nepalese, [13] Bangladeshi and Javanese children.[14] Despite the differences in the deciduous teeth eruption process, the sequence of eruption found to be same as those for the other South Asian countries, as "A B D C E". Sequence of eruption of maxillary first molars and second molars was delayed than to their mandibular counterparts. Comparing the maxillary and mandibular arches, the first tooth to erupt is mandibular central incisor at 10 months of age and the last deciduous tooth to erupt in the oral cavity is maxillary second molar at 30 months. The reason for this variation is due to disparity in geographic, climatic and environmental conditions prevailing in this region.

Mandibular left and right lateral incisors was erupted at 13.21 and 13.32 ± 0.04 months respectively, which was reported age for Japanese children [4] followed by maxillary right and left lateral incisor was at 14.14 ± 0.33 and 14.15months respectively which was 2 months delayed compared to Japanese [4]Javanese [14]and Nepalese children [13]but similar time of eruption reported for Indian children in other parts of the country.[11,15,16] Maxillary left first molar erupted early at 18.46 ± 0.53 months than right side at 18.57 months followed by which mandibular left and right first molars erupted at 19.09 ± 0.38 and 19.13 ± 0.35 months respectively. Last teeth in this group were maxillary canines at 22.03 ± 0.26 months. The mean age of eruption for posterior teeth was similar to the previous Indian study.[15]

Group II described the mean age of eruption of teeth of subjects from 13 to 24 months. At 14.5± 2.12 months maxillary right lateral incisor and at 18.33 ± 1.14 months left side lateral incisor had erupted. Mandibular left and right lateral incisors erupted at 14.73 ± 0.85 months and 14.87 ± 0.94 months respectively.

After lateral incisors, maxillary left first molar began to erupt at 18.45 months followed by mandibular left and right first molars at 18.51 ± 0.59 and 18.59 ± 0.68 months respectively. Last first molar to erupt was maxillary right side at 18.97 ± 0.17 months. Maxillary and mandibular right side canines were erupted earlier at 24.34 ± 0.26 and 19.34 ± 7.18 months than left side at 24.45 ± 0.13 and 24.35 ± 0.16 months respectively. All the mean age of eruption

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reported in our study except for canine were similar with the other Indian studies,[15]but with 2 months of delayed eruption when compared to Bangladeshi and Javanese children.[14]

Subjects of age 25 to 36 months were detailed in group III, where canines and second molars were seen to be erupted. Maxillary canine had erupted earlier than mandibular at 24 and 24.5 ± 0.71 months respectively which is 2 months earlier than the Mangalore children [11], 2 months of delay in Hyderabad children [16], while mandibular second molars erupted earlier than maxillary at 29 and 30 months respectively.

Pictorial representation of Figure 1 shows the mean age of eruption of teeth in standard data whereas Figure no. 2 showed mean age of eruption of deciduous teeth of children of Rajnandgaon with a difference of 4 months delay in eruption of deciduous teeth, similar data was reported by Bangladeshi [14] and Nepalese [13] children. Comparision can be made by this figure along with that sequence of eruption of deciduous teeth can be determined. Sequence was similar to standard data and to the other studies. Posterior teeth began to erupt at 18-19 months of age with delayed of approximately 6 months, where 3 months delay for Egyptian [17, 24] children and 2 months delayed in Nigerian [6, 25]children. Mandibular 1st molar followed by maxillary 1st molar erupted at 18.57 – 18.97 months. Maxillary canine erupted earlier at 22.03-24 months then mandibular canine, which was erupted at 24.5 – 25.35 months with the delayed period of 5 and 8 months respectively as compared to standard data [7]. Similar to the standard data second molar was last teeth to erupt, i.e mandibular at 29.43 – 29.32 months and maxillary at 30-31 months delayed by 9 and 6 months.

There are further discrepancies when compared to study by Holman and Jones in 1988 for Bangladesh population in which there is a difference of two months between eruption ages, with their results being always earlier.[14]Study by Gupta et al (2007) [13]for Nepal population in which there is a one to three months difference in eruption age when compared with present data.

Townsend and Hammel [18] also noted that children of African descent acquire their teeth earlier than European children, while Asian children show a delayed eruption of first teeth. Similarly the present study showed a delayed type of eruption as compared to Caucasian population. It was seen that dental eruption and skeletal growth are strongly associated with each other.[19] Eruption of teeth is found to be positively related to somatic growth. Very few studies have related the eruption timing with birth weight, feeding habits, and socioeconomic status.

Malnutrition and poor nutrition in early childhood affects tooth eruption and results in delayed emergence of teeth. Feeding habits and Birth weight has been related to the rate of dental development as observed that low-weight children have dental delay [20, 22]*So* in this study, factors like birth weight, and socioeconomic status, feeding type, duration etc. were considered to check the effect on tooth eruption.

The effect of breastfeeding was also examined in the study by Ntani et al [21]. They found that children who were breastfed for longer than seven months had delayed primary tooth eruption and fewer teeth at one and two years. In accordance with this study, present study also showed significant difference for the type and duration of feeding onto the eruption of teeth.

Milk product such as cerelac or dexolac or other used to feed the children was also summarized in this table. Use of Cerelac was found to be significantly more in group II and III than Dexolac. Regression analysis was made between the variables and the mean age of eruption of first tooth to determine the effect. Beta coefficient for each variable showed positive effect on eruption of teeth i.e as the values for each variable increase, there will be increase in the duration of eruption of teeth. Significant difference was found for the feeding type and duration of feeding for the child as p=0.04 and 0.01 respectively.

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Conclusion

Hence, Studies conducted to evaluate time to time estimation of variation of eruption sequence among different populations is important for general dental practitioners, and pediatric dentists to contend with the anxiety of the parents.

The findings of this study establish a new chronological table for eruption of primary teeth in children of Rajnandgaon. In the present study, a deviation in the eruption timing and sequence of eruption was noticed hence, it is important that the standard for tooth eruption which is derived from the population to which they are to be applied. For which requires further studies using larger group of population. So it helps to implement various preventive programs and for age estimation.

Acknowledgement

We thank the health centres and aanganwadis of Rajnandgaon for permitting to exam the children. Informed consent was provided from the parents and procedure was done under ethical consideration.

Conflict of interest

There is no conflict of interest in this work.

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