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Polymorphism in emergence of deciduous dentition: A cross-sectional study of Indian children

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Abstract

Aim: The aim of the present study was to evaluate the timing and sequence of the eruption of deciduous teeth in Indian children.

Method: This cross-sectional study focused on children aged 5-36 months. One hospital was randomly selected from four geographic zones of the city. A total of 400 children from each hospital, fulfilling the inclusion criteria, constituted the sample. The examination was carried out by a single, trained examiner. The tooth was recorded as "present" or "absent" on the day of examination. The mean age of emergence was calculated using a probit model. Independent sample *t*-test was used to assess the statistical significance of differences in the mean age of tooth emergence.

Results: The deciduous mandibular central incisor was the first tooth to erupt in the oral cavity (8.15±1.69 months). Girls showed delayed eruption compared to boys; however, no interarch variation was observed in the mean age of tooth eruption. There was also no difference in the sequence of eruption of deciduous teeth, as reported in other studies.

Conclusions: The present study establishes a chronological table for the eruption of deciduous teeth in Indian children. There was delayed eruption of deciduous teeth when compared to the reference ranges of Western populations.

KEYWORDS

deciduous dentition, eruption pattern, eruption timing, Indian children, sequence

1 | INTRODUCTION

The eruption and exfoliation of deciduous teeth followed by the emergence of succedaneous permanent dentition is an orderly, sequential, and age-specific event. Tooth eruption is one of the vital milestones during a child's development; therefore, the majority of parents are often concerned with the timing of tooth eruption. An erupted tooth has been defined as a tooth with any part of its crown penetrating the gingiva and which is visible in the oral cavity.[1,2]

Developing dentition and eruption pattern could be used to assess growth, maturity, and age estimation in many disciplines, including anthropology, forensic science, pediatric odontology, and orthodontics.[3] Vital differences between the chronological age and biologic (dental) age of a child could reflect underlying past and present local or systemic disturbances.

There is an appreciable variation in both the sequence and timing of tooth eruption across the globe. The eruption of teeth, recognized as an aspect of human growth and development, might presumably be influenced by a number of factors, such as genetics, environment, and consanguineous marriages.[4] Eruption timing of permanent dentition in several populations has been widely reported, whereas very few studies have been published on deciduous dentition. A study on Saudi Arabian children showed a delay in eruption of deciduous teeth in comparison with Caucasian children.[5] Children in Iceland have been shown to possess similar mean emergence ages of deciduous teeth as Scandinavian children.[6]

TABLE 1 Demographic characteristics of the study population

Group	Age group (mo)	Class interval (mo)	Males (n)	Females (n)	No. participants (%)
Group I	5-12	7	160	170	330 (20.5)
Group II	13-18	6	172	152	324 (20.2)
Group III	19-24	6	174	124	298 (18.6)
Group IV	25-30	6	160	172	332 (20.7)
Group V	31-36	6	178	144	322 (20.0)
Total			844	762	1606 (100)

There is little research on primary tooth eruption in the Indian population, and information on the eruption age of primary teeth used in clinical and academic situations in India is mostly based on other populations. Because cultural and environmental factors vary with different geographic locations, which can affect the timing of tooth eruption, it is preferable not to adopt references from other countries as standard for Indians.[7]

Therefore, there was a need to conduct a study on the emergence pattern and sequence of deciduous teeth in Indian children. This cross-sectional study was based on the hypothesis that, based on a similar age group, there is a general tendency of delayed eruption of deciduous dentition in Indian children compared to other races.

2 | MATERIALS AND METHODS

This cross-sectional study was conducted in a major city of North India. Ethical approval was obtained from the institutional review board and university ethical committee. The sample size was estimated to be 1480, with permissible error at 5%, power of the study being 80%, and confidence level of 95%. The sample of 1480 children was based on the indirect estimation of sample size from the provisional census data of 2011 for the state.[8]

The children were selected from four tertiary care public sector hospitals of the city. One hospital was randomly selected by lottery method from each of four geographic zones of the city. A total of 425 children from each of the hospital were selected to meet the required sample size. A schedule was drawn for periodic visits to the four selected hospitals comprising one visit to each in 1 week. A total of 1700 children were screened (accounting for a possible attrition in sample size by 10%) in the age range of 5-36 months.

Children who met the inclusion criteria on the respective days of the visit to the hospital were included in the study: (a) were aged 5-36 months; (b) were clinically healthy; (c) were born at full term (38-40 weeks) with an average birth weight (≥2500 g); (d) and whose parent/guardian were willing to provide written, informed consent.

The chronological age of the child was calculated in months from their birth certificate/hospital records. All the children were examined by a single examiner. The examination was done in natural daylight. The findings were recorded in an examination sheet for every child. Teeth were recorded as "present" or "absent". Teeth that were present or erupted were defined as teeth with any part of the crown penetrating the gingiva and were visible within the mouth. Extracted teeth were regarded as having emerged.

2.1 | Statistical analysis

Statistical analysis was done using SPSS version 19.0 software (SPSS, Chicago, IL, USA). The independent sample *t*-test was used to assess the statistical significance of differences in the mean age of tooth emergence between males and females, between the upper and lower arches and between the left and right sides of the arch, at 5% probability level ($P<.05$).

For calculating the mean age of emergence for each tooth, the probit model was adopted. The probit analysis was done using StatsDirect (StatsDirect, Altrincham, Cheshire, UK). The mean and standard deviation were calculated from the model.

3 | RESULTS

Out of a total of 1700 children screened, data for 1606 children were analyzed. Incomplete datasets were excluded from the analysis. A total of 844 (52.6%) boys and 762 (47.4%) girls constituted the final sample. The sample was stratified into five groups according to age. There were 330 (20.5%) children in the 5-12 months age group, 324 (20.2%) children in the 13-18 months age group, 298 (18.6%) children in the 19-24 months age group, 332 (20.7%) children in the 25-30 months age group, and 322 (20%) children in the 31-36 months age group (Table 1).

3.1 | Intra-arch comparison of mean age of eruption of deciduous teeth

There was no significant difference found between the left and right sides in either of the arches ($P>.05$). There was a systematic tendency for early eruption of deciduous teeth on the left side, although the difference was not significant (Table 2).

3.2 | Interarch comparison of mean age of eruption of deciduous teeth

As there was no significant difference in eruption ages on the right and left sides, right side values were taken for comparison.

TABLE 2 Mean age with standard deviation (months) of eruption of deciduous teeth in total sample

Teeth	Arch	Mean age and standard deviation (months)		
		Total sample	Females	Males
Central incisor	Maxillary	9.74±0.97	9.88±1.51	9.67±1.19
	Mandibular	8.30±1.06	8.43±1.45	8.15±1.69
Lateral incisor	Maxillary	11.57±0.98	12.04±1.49	11.18±1.33
	Mandibular	14.05±0.97	14.37±1.43	13.80±1.36
Canine	Maxillary	18.57±1.13	19.21±1.61	18.11±1.58
	Mandibular	20.55±1.58	21.45±1.82	19.87±1.61
First molar	Maxillary	14.71±0.89	15.08±2.01	14.41±1.22
	Mandibular	16.21±0.97	16.60±1.51	15.92±1.28
Second molar	Maxillary	27.80±1.23	28.28±1.59	27.45±1.83
	Mandibular	26.78±1.20	27.35±1.65	26.31±1.70

On comparing the maxillary and mandibular arches, the mandibular central incisor (9.74±0.97 months), and the mandibular second molar (26.78±1.20 months) erupted before their maxillary counterparts (8.30±1.06 and 27.80±1.23 months, respectively). The lateral incisor (11.57±0.98 months), canine (18.57±1.13 months), and first molar (14.71±0.89 months) in the maxillary arch erupted before their mandibular counterparts (14.05±0.97, 20.55±1.58, and 16.21±0.97 months for the mandibular lateral incisor, canine, and first molar, respectively). All the interarch differences were found to be statistically significant (Table 2).

3.3 | Gender variations in the mean ages of eruption of deciduous teeth

Overall, girls showed delayed eruption compared to boys, although the difference was significant only for the maxillary and mandibular canine and second molar ($P \leq .05$) (Table 2).

4 | DISCUSSION

The mean eruption age of deciduous teeth has been determined for many population groups with variations in the timing of emergence. This can be because of potential variations within the genetic constitution, and also the environment of the groups studied. Very few studies have been conducted on Indian children. Furthermore, the studies that have been conducted were done nearly a decade ago. Currently, there are modifications in environmental factors, dietary habits, cultural habits, industrialization, increased consanguineous, and inter-religious marriages. These attributes could have an effect on overall growth with a possible change in the eruption pattern. Thus, it is essential to study the dynamic pattern of eruption, which is predominantly influenced by th.ese variables.

Genetics has been established to have strong influence on the eruption timing and sequence of teeth. Numerous studies have been done on different population groups owing to the influence of genetics and environment on eruption time and the sequence of teeth, highlighting the need for this study.[1,9–11]

According to Dahlberg and Menegaz-Bock, the cross-sectional technique is preferred over the longitudinal study design when considering emergence pattern, as cross-sectional designs are amenable to incorporate larger samples, thereby yielding results that are representative of the population.[10] Additionally, the risk of bias is lower in a cross-sectional study than in a longitudinal study.

Heidmann suggested that the probit analysis was the best technique for analyzing tooth eruption. In the present study, the probit analysis was used for the estimation of the mean age of the eruption of deciduous teeth.[12] The probit (normal sigmoid) provides the foremost closely-fitting result. Probit transformation additionally helps in calculating the average eruption of teeth and in deciding the percentage of participants in whom the tooth was present at a specific age.[13]

The results showed no significant difference in eruption time of the contralateral deciduous teeth, thus the eruption time and sequence of only the right side of the maxilla and mandible was considered for analysis. Heikkinen et al. suggested that symmetry in tooth emergence is directly related to the developmental time span for every specific category of teeth.[14] This could imply that the deciduous dentition exhibits less imbalance than the secondary dentition because of a controlled intrauterine atmosphere and a shorter period of calcification and development.[15] Consequently, the lack of significant imbalance found on the right and left sides in the present study was justifiable. Poureslami et al. suggested that the eruption timing of first deciduous teeth is related to the eruption timing of the first permanent molar.[16]

In the current study, there was a general tendency for teeth to erupt earlier in boys in both jaws, although the difference was statistically significant only for the canine and second molar. Gender variations in the emergence of deciduous teeth have not been clearly established.[17] Magnusson reported significant earlier eruption in girls compared to boys;[7] however, other researchers, such as Al-Jasser and Bello, Tanguay et al., and Holman and Jones have reported earlier eruption in boys.[1,6,18] In Soliman et al. and Vejdani et al.'s studies, boys were found to lag behind girls in the emergence of all deciduous teeth except first molars.[19,20] Tanguay et al. proposed that ethnic factors might mediate sex variations in tooth emergence.[6] Therefore, no single pattern worldwide could be observed characterizing the sex variations in the pattern and timing of emergence. Meredith reported

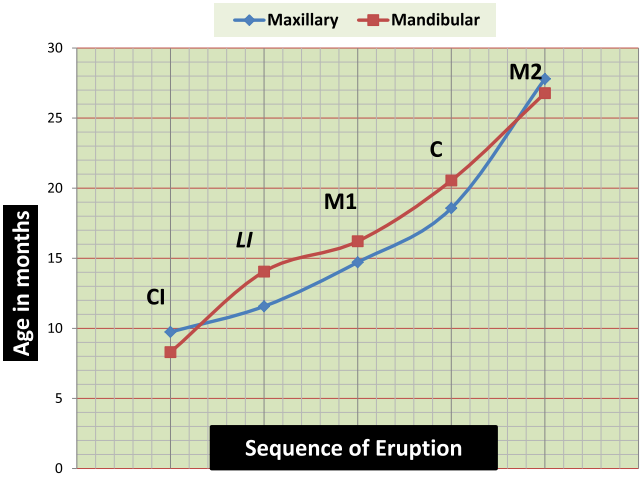

FIGURE 1 Mean age (months) of eruption and sequence of eruption of deciduous teeth. C, deciduous canine; CI, deciduous central incisor; LI, deciduous lateral incisor; M1, first deciduous molar; M2, second deciduous molar

accelerated growth in boys during the first trimester as the reason for earlier emergence of deciduous teeth in boys.[21]

When considering the study group, it was found that the mean ages of eruption of mandibular central incisors and second molars were less than the maxillary ones, whereas for lateral incisors, canines, and first molars, the maxilla preceded the mandible. This was in accordance with the findings of Logan and Kronfeld, who suggested that lateral incisors, canines, and first molars erupt earlier in the upper jaw compared to their mandibular counterparts.[22] Consistent with the literature, the findings of the present study indicated the most common sequence of deciduous tooth emergence in both the arches, suggesting an extremely coordinated underlying process. There was no difference in the sequence of emergence found with regard to gender. Based on the mean ages of eruption, the sequence of eruption was deduced as follows: mandibular central incisor>maxillary central incisor>maxillary lateral incisor>mandibular lateral incisor>maxillary first molar>mandibular first molar>maxillary canine>mandibular canine>-mandibular second molar>maxillary second molar (Figure 1).

The sequence of eruption of deciduous teeth was consistent with the findings already reported in the literature. However, the study population showed a marked delay in the eruption time of deciduous teeth compared to that reported by Logan and Kronfeld.[22] Because the eruption of teeth is a developmental milestone, a reference table for the age of eruption needs to be established for this population. India houses almost one-fifth of world's population, and has varied living conditions compared to that of the Western world. The influence of these factors cannot be ignored in the pretext of the eruption time of deciduous teeth. Factors, such as nutrition, socioeconomic status, climate, and environmental factors, including fluoride content in drinking water, have been attributed to variations in the chronology of eruption.[23,24] However, the results are inconsistent and inconclusive with regard to any one factor.[25]

The Indian population is made up of many races and ethnicities. Similar findings have been reported by GunaShekhar and Tenny, who found that boys had earlier eruption compared to girls, and the study population experienced delayed eruption of primary teeth when compared to their counterparts in other populations.[26] Because the Indian population is multiethnic in nature, the result warrants the need for a study to be conducted on a larger scale, controlling for the effect of different ethnic backgrounds and socioeconomic conditions. Therefore, the study results could be generalizable to the Indian population if done so cautiously. There are also obvious limitations when making comparisons between studies that vary in modes of data collection, analysis, and sample size. Therefore, interpretations should also be made with caution.

As hypothesized, there was a visible difference in the eruption timings of deciduous dentition in Indian children. These children experienced delayed eruption of deciduous teeth compared to their counterparts in other populations, as shown in Table 3 (Nigeria, USA, and Iceland).[6,23,24] Nepalese children have also been found to have delayed eruption compared to the Western population.[27]

TABLE 3 Comparison of mean eruption age (months) of deciduous teeth in males and females of various countries

		Current study (India)		Nigeria		Iceland		USA	
Arch	Teeth	Males	Females	Males	Females	Males	Females	Males	Females
Maxillary	Central incisor	9.67	9.81	9.29[a]	10.06[b]	8.99[a]	9.21[a]	9.36[a]	8.76[a]
	Lateral incisor	11.18	12.04	11.98[b]	12.94[b]	10.38[a]	10.16[a]	12.00[b]	11.76[a]
	Canine	18.11	19.21	17.82[a]	18.27[a]	17.59[a]	17.98[a]	21.00[b]	20.76[b]
	First molar	14.41	15.08	16.03[b]	15.99[b]	15.10[b]	14.95[a]	17.52[b]	16.32[b]
	Second molar	27.45	28.28	26.11[a]	26.11[a]	26.13[a]	25.11[a]	30.96[b]	31.44[b]
Mandibular	Central incisor	8.15	8.43	7.55[a]	7.88[a]	8.03[a]	6.89[a]	7.20[a]	7.68[a]
	Lateral incisor	13.80	14.37	12.42[a]	12.92[a]	12.08[a]	11.75[a]	13.08[a]	13.32[a]
	Canine	19.87	21.45	18.19[a]	18.77[a]	19.16[a]	18.14[a]	20.88[b]	20.52[a]
	First molar	15.92	16.60	16.27[b]	16.00[a]	16.16[b]	15.43[a]	16.56[b]	16.44[a]
	Second molar	26.31	27.35	24.13[a]	24.20[a]	25.62[a]	23.74[a]	30.00[b]	29.52[b]

[a]Earlier eruption compared to current study.
[b]Delayed eruption compared to current study.

5 | Conclusion

In the present study, we established a chronological table for the eruption of deciduous teeth in Indian children. The eruption age of deciduous dentition in Indian children is not the same as that reported for other populations. There is a delay in the eruption age in Indian children compared to their counterparts from the Western world.

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