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Original Article

Dentistry Section

A Cross-sectional Study of Eruption Time of Primary Teeth in South Indian Children

GUNASHEKHAR MADIRAJU[1], HARSHA BASAVARAJA[2]

ABSTRACT

Introduction: Eruption chronology of primary teeth can be a very valuable asset in the diagnosis and treatment planning of children in the field of dentistry.

Aim: The present study aimed to determine the mean eruption time and sequence of eruption of primary teeth in South Indian children.

Materials and Methods: This cross-sectional study from September 2017 to December 2018 involved a random sample of 954 South Indian children (452 boys and 502 girls) aged six to thirty-six months. The mean age of eruption for each tooth was calculated using the Karber method, as modified by Hayes and Mantel. The student t-test was used to assess possible differences in the mean age of primary teeth eruption between males and females for both the maxilla and mandible.

Results: The mandibular central incisors were the first teeth to erupt with an overall mean eruption time of 10.3±0.6 months. Girls displayed significant earlier eruption of first primary molar in both the maxilla and the mandible ($p<0.05$).

Conclusion: South Indian children experienced delayed eruption of primary teeth when compared to their counterparts in other populations. Data from the present study can be used as a reference. The mean age of eruption was 10.2±0.79 months in boys and 10.4±0.38 months in girls. All the teeth, except canines and first molars emerged earlier in the mandible in both the genders.

Keywords: Children, Chronology, Deciduous teeth, Eruption sequence, Tooth eruption

INTRODUCTION

Eruption timing and sequence of the primary teeth provides dental clinicians, a reliable indication of maturation and biological age and aids in the assessment of growth and maturity in orthodontics including age estimation in forensic sciences. Standard reference age for eruption of primary dentition utilised for academic and research purposes were derived from studies carried out in western population groups [1,2]. This data cannot be applied to Indian population owing to environmental, racial and genetic variations. Although several factors have been thought to influence the primary teeth eruption including ethnicity [3,4], socioeconomic status [5], type of feeding [6] and environmental factors [7,8], the role of these factors were inconsistent in the literature. Definitive evidence exists to show that children from different geographic regions have different eruption pattern of primary teeth [9-14]. Indeed, the standards for emergence of primary teeth for a certain ethnic group should be obtained from that population.

Indian peninsula constitutes the second largest populated country in the world with diverse ethnicity and geographical conditions. However, there is little research conducted on the eruption chronology of primary dentition in Indian children [13-17]. The purpose of the present study was to determine the mean eruption time and sequence of eruption of primary teeth in South Indian children.

MATERIALS AND METHODS

The present cross-sectional study was conducted by CDH Research Centre, Bangalore and included a sample of 954 South Indian children between the age of six and thirty-six months during the period from September 2017 to December 2018. The sample was collected from randomly selected primary health centers from eight different locations of southern India, in order to represent children from different geographic localities. Children visit these health centers regularly in order to receive their mandatory vaccinations. Parents were informed about the study during the national immunization days and a written informed consent was obtained from those who agreed to participate in the study. The study was reviewed and approved by the institutional review board (CDC/CDHRC/011/2017-B). Participation was voluntary and a valid birth proof was sought for birth date confirmation.

Inclusion Criteria

Both the parents including the child were of Indian origin, had a history of full-term birth, were clinically healthy with a negative history of early childhood diseases requiring hospitalisation. Children who met the inclusion criteria on the respective days of the visit to the hospital were included in the study.

Exclusion Criteria

Children with a history of chronic infectious systemic diseases, nutritional or endocrinal disturbances, recognised syndromes and developmental disturbances such as cleft lip and palate were excluded from the study.

Out of the initial sample of 1080 children, 126 children without accurate birth proofs were excluded resulting in a final sample of 954 children.

Study parameters included age of eruption of primary teeth in months, on both right and left sides of maxilla and mandible in both the genders. The age of each child was calculated in months from his/her date of birth to the date of examination. The teeth were recorded as either present (when any part of its crown had penetrated the mucous membrane and is visible in the oral cavity) or absent [9,10,13]. Plain mouth mirrors and/or wooden tongue blades were used for oral examination in the presence of good illumination with the child seated either on parent's lap or on an ordinary chair (depending on age) along with the parent. The oral examination at respective immunisation centers was carried out by a pre-calibrated pedodontist and was recorded by a trained data recorder. One of the principal examiners (GM) was calibrated in a pilot study consisting of 30 subjects. All the subjects were checked twice at an interval of 1 week between the two visits and a kappa score of 0.91 was obtained for intra-examiner reliability. These subjects were not included in the main study. The mean age of eruption for each tooth was calculated using the Karber method, as modified by Hayes RL and Mantel N (1958) [18].

STATISTICAL ANALYSIS

The data were analysed using SPSS version 16.0 software (SPSS, Chicago, IL, USA). Descriptive statistics including means and standard

deviations were calculated for all variables. Student's t-test and paired t-test were used to assess the statistical significance of differences in the mean ages of tooth eruption between the gender, and between the upper and lower arches respectively at 5% probability level ($p<0.05$).

RESULTS

The present study examined 954 Indian children of which 452 (47.4%) were boys and 502 (52.6%) were girls. Since there were no significant differences in the mean age of eruption of the teeth on the right and left sides for both the maxilla and mandible, an average of the mean eruption age of each pair of teeth in both the arches was calculated for males and females, as has been done in most previous studies on the emergence ages of the teeth [9,10]. The results obtained for mean eruption time of primary teeth including Standard Deviation (SD) and Standard Error of Mean (SEM) has been presented in [Table/Fig-1]. The mandibular central incisors were the first teeth to erupt with an overall mean eruption time of 10.3±0.6 months (Mean±SD). The mean age of eruption was 10.2±0.79 months and 10.4±0.38 months in boys and girls respectively.

Tooth	Boys			Girls		
	Mean (months)	SD (months)	SEM (months)	Mean (months)	SD (months)	SEM (months)
51,61	12.07	0.74	0.10	12.34	0.89	0.11
52,62	13.42	0.98	0.13	14.02	0.63	0.10
53,63	21.52	1.15	0.18	21.81	0.59	0.08
54,64	18.19	0.88	0.13	17.14	1.11	0.17
55,65	29.12	0.89	0.12	28.83	0.73	0.10
71,81	10.19	0.79	0.098	10.37	0.38	0.05
72,82	13.27	0.85	0.13	13.00	0.76	0.12
73,83	22.02	1.20	0.19	22.37	0.75	0.11
74,84	19.23	0.81	0.13	18.49	0.47	0.07
75,85	27.59	1.43	0.25	27.14	0.79	0.11

[Table/Fig-1]: Mean, SD and SEM in months, of eruption for primary teeth in boys and girls.
SD: Standard deviation; SEM: Standard error of mean

Comparison of gender showed a tendency towards earlier eruption in boys for all teeth except that the mandibular lateral incisors and first and second primary molars in both the arches erupted earlier in girls. However, statistically significant difference were noted in girls only for the first primary molar in both maxilla and mandible ($p<0.05$). Further, earlier eruption of the maxillary lateral incisor in boys was significant compared to that in girls ($p<0.05$). When the maxillary and mandibular arches were compared, there was a tendency for central incisors, lateral incisors, and second molars to be chronologically advanced in the mandible as compared to the maxillary counterparts, while canines and first molars emerged earlier in the maxilla, in both boys and girls. The sequence of eruption of teeth was identical in both the genders and was in the following order of eruption: central incisors, lateral incisors, first molar, canine and second molar.

DISCUSSION

Wide variations in the emergence time of primary teeth among different population groups have been reported in the literature. The emergence of primary teeth in south Indian children in the present study commenced approximately at the mean age of 10.3 months among both the genders. This finding was found to be later than those reported by other recent studies conducted in Lucknow by Kariya P et al., and in Mysore by Indira MD et al., [13,16], but earlier when compared to those reported by Gunashekhar M et al., in Hyderabad (10.72 months) and Verma N et al., in Bhopal (11.4 months) [14,17]. Disparities in the eruption times of primary teeth in south Indian children have been noted when compared to that in the north Indian children [Table/Fig-2]. These differences might be partly due to variations in the study design and sampling techniques.

Tooth	Kariya P et al., [13]	Verma N et al., [17]	Singh K et al., [15]	Indira MD et al., [16]	Present study
	North India			South India	
Maxilla (months)					
Central incisor	9.74	12.8	9.48	11.1	12.21
Lateral incisor	11.57	14.3	10.20	13.19	13.72
Canine	18.57	22.8	19.20	19.13	21.67
First molar	14.71	18.6	15.7	16.15	17.67
Second molar	27.80	30.1	27.7	29.18	28.98
Mandible (months)					
Central incisor	8.30	11.4	8.28	10.21	10.28
Lateral incisor	14.05	14.8	10.20	15.73	13.14
Canine	20.55	23.3	19.32	21.24	22.12
First molar	16.21	19.03	15.12	17.10	18.86
Second molar	26.78	29.8	27.7	28.51	27.37

[Table/Fig-2]: Comparison of mean ages (in months) of eruption of primary teeth in both the arches combined by gender and sides (Right/Left) in Indian population.

Genetic, racial and environmental differences may vary considerably between Indian and other population groups. Studies conducted on populations of other global ethnic groups in Nepal, Saudi Arabia, and Egypt were cross-sectional and used comparable criteria for tooth emergence [Table/Fig-3]. The present study demonstrated delayed eruption times of the first primary tooth in south Indian children when compared to the data from other studies [9-12]. Although Nepal is geographically located adjacent to India, slight differences in the eruption times in both the genders were noted when compared to those of Indian counterparts [11]. Whilst these findings might suggest possible role of genetics and/or ethnicity in the emergence of primary teeth, the evidence in the literature regarding the role of ethnicity is unclear. Numerous studies conducted on different population groups have shown a strong influence of genetics on the timing and sequence of eruption of teeth [12,19,20]. The sequence of eruption of primary teeth was consistent with the findings in the literature and followed the typical trend in both boys and girls, i.e., central incisors, lateral incisors, first molar, and canine followed by the second molar [10,13,16,17].

Arch	Tooth	Saudi Arabia [12]		Egypt [10]		Nepal [11]		India (Present study)	
		Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Maxilla	Central incisor	11.19	11.20	9.8	9.9	12.67	10.33	12.1	12.3
	Lateral incisor	13.09	13.31	12.0	13.2	14.00	11.50	13.4	14.0
	Canine	21.14	21.03	19.4	19.9	19.10	18.80	21.5	21.8
	First molar	16.88	16.90	17.1	17.0	15.86	14.71	18.2	17.1
	Second molar	28.16	28.25	25.4	28.0	26.67	25.00	29.1	28.8
Mandible	Central incisor	8.44	8.49	8.0	7.8	10.50	9.50	10.2	10.4
	Lateral incisor	14.44	14.61	13.0	13.1	13.50	12.00	13.3	13.0
	Canine	21.03	21.10	20.3	19.5	21.43	21.50	22.0	22.4
	First molar	17.17	17.13	17.0	16.7	14.40	16.25	19.2	18.5
	Second molar	27.92	27.97	25.6	28.1	25.33	27.00	27.6	27.1

[Table/Fig-3]: Comparison of mean difference ages (in months) of eruption of primary teeth in both the arches combined by sides (Right/Left) in global population.

In the present study, boys showed a tendency towards earlier eruption for anterior teeth except the mandibular lateral incisors, whereas first and second primary molars in both the arches including mandibular lateral incisors erupted earlier in girls. Gender variations in the eruption times and pattern of primary teeth have not been clearly established [10]. Earlier onset of teeth maturation has been attributed to advanced eruption times of teeth in girls [21]. Meredith HV (1946) had reported that earlier eruption of primary teeth in boys might be due to accelerated growth in boys during the first trimester [22]. However, most studies support the hypothesis of developmental cross-over pattern suggested by Demirijian A and Levesque GY, which states that anterior teeth erupt earlier in males and posterior teeth in females [23]. Reports suggest that this pattern appears to follow a spatial gradient of tooth position, corresponding to gender differences arising early in dental development [24]. In the present study, this pattern was evident except for mandibular lateral incisor which erupted earlier in girls but was not statistically significant and only the first primary molars emerged significantly earlier in girls in both the arches.

Many studies on tooth emergence have shown insignificant differences in the eruption times of teeth in the left and right side of the dental arch [9,15]. Hence, in the present study, this variable was not evaluated and the combined mean eruption times of both sides of each arch was considered for analysis. Contradicting the general agreement that lateral incisors erupt first in the maxilla, this study reported earlier eruption of lateral incisors in the mandible in both girls ($p<0.05$) and boys ($p>0.05$). The earlier eruption of second primary molars in the mandible and the eruption of canines and first molars to be chronologically advanced in the maxilla is in line with other studies [9,13,14,17]. On the contrary, however, earlier emergence of first primary molar in the mandible has also been reported [10,16]. Differences in the eruption times of primary teeth have been reported to be affected by various significant determinants including low birth weight, gestational age, and chronic malnutrition [8,17,25,26].

Limitation(s)

In the present study, only those children with a history of full-term birth were included and hence the impact of gestational age and birth weight on primary tooth eruption chronology could not be evaluated. Further since this study study focused only on healthy children attending primary health centers, assessment of the effect of nutritional and socioeconomic status on tooth eruption times was not possible. Although the present study determined the eruption times of primary teeth, the possible role of these external environmental factors causing variations in the emergence times of primary teeth in Indian children should be extensively explored.

CONCLUSION(S)

Primary tooth eruption in south Indian children occurred later when compared to their counterparts in other population groups. The eruption of the first primary molar occurred earlier in boys compared to that in girls. Multiethnic nature of Indian population warrants the need for further studies on a larger scale to explore the influence of genetic and external environmental factors.

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PARTICULARS OF CONTRIBUTORS:
1. Faculty of Dentistry, Preventive Dentistry, King Faisal University AlHassa, Saudi Arabia.
2. Faculty of Orthodontics, Department of Orthodontics, KIMS Dental College and Hospital, Amalapuram, Andhra Pradesh, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Gunashekhar Madiraju,
C/o Chinmayee Dental Care and Orthodontic Centre, Bangalore, Karnataka, India.
E-mail: indshe117@gmail.com

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