

Eruption Chronology of Primary Teeth in Nigerian Children

Elizabeth Obhioneh Oziegbe* / Comfort Adekoya-Sofowora **/ Temitope Ayodeji Esan*** / Foluso John Owotade ****

*The eruption chronology of the primary dentition has been studied in some populations, however; only few studies from Nigeria and other African countries have been reported. **OBJECTIVE:** To determine the appropriate reference standard for eruption of primary teeth in Nigerian children. **SUBJECTS AND METHODS:** A cross sectional study consisting of 1,013 clinically healthy babies, infants and preschool children between the ages of 4 to 36 months from the community health centers immunization clinics in Ife Central and Ife East Local Government Areas. **RESULTS:** Boys erupted primary teeth earlier than girls in both arches except the first molars. However, girls had a shorter duration of eruption (from the first tooth to erupt to the last tooth to erupt) when compared to boys. In addition, boys had a systematic tendency for earlier eruption on the left side. **CONCLUSION:** Within the limitations of this study, a baseline data for eruption of primary teeth among Nigerian children has been established. Nigerian children experienced an earlier eruption of primary teeth when compared to their Arabian and American counterparts and a later eruption when compared to children from Iceland.*

Keywords: tooth, eruption, primary dentition.

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INTRODUCTION

The study of the dentition has a long tradition in physical and biological anthropology.¹⁻⁵ While both, primary and permanent tooth emergence have been studied in many human populations, important issues surrounding these biological milestones remain unsolved.⁶

One of the biological milestones issues is age. Several studies have shown variations in individual primary tooth eruption age,⁷⁻⁹ as well as variations in the factors that may likely affect the time and sequence of primary teeth emergence. These studies performed in Saudi Arabian children, show a delay in eruption of primary teeth when compared with Caucasian children.¹⁰ Children in Iceland have shown to

have similar mean emergence ages of primary teeth as Scandinavian children.¹¹ Even within the same geographic area, there are variations in the timing of eruption of the primary dentition as demonstrated by Holman and Jones.⁶ They showed that Japanese children have a significantly faster emergence for most teeth than do children from Java, Bangladesh and Guatemala.⁶

Variations in the pattern of tooth eruption have been shown to be associated with gender. A comparative study of primary teeth emergence age by gender in Iceland, revealed that eight out of ten teeth emerged earlier in girls; however, the difference was significant only for mandibular central incisors and second molars.¹¹ Kitamura¹⁹ also concluded that girls' teeth emerged earlier than boys' teeth. Demirjian,²⁰ and Holman and Jones^{6,21} noted that boys displayed an accelerated emergence of the anterior dentition while posterior emergence was retarded. However, several other studies have shown no gender difference in the timing of eruption of primary teeth.^{13, 22, 23-26}

While eruption chronology of the primary dentition has been studied in some populations,²⁷⁻³² only a few studies from Nigeria^{13,29} and other African countries^{26,27} have been reported. Thus, it is important to undertake this type of study in Nigeria to determine the appropriate reference standard for eruption of primary teeth in Nigerian children. Furthermore, the teeth present in the mouth at a particular age may play an important role in forensic identification.

SUBJECTS AND METHODS

This cross sectional study included a population of consecu-

* Elizabeth Obhioneh Oziegbe BCH.D, FMCDS Department of child dental health, the Faculty of Dentistry, Obafemi Awolowo University, Ile-Ife, Osun –State, Nigeria.

** Comfort Adekoya-Sofowora BDS, MDS, FMCDS, FWACS Department of child dental health, the Faculty of Dentistry, Obafemi Awolowo University, Ile-Ife, Osun –State, Nigeria.

*** Temitope Ayodeji Esan BCH.D, FMCDS Department of restorative dentistry, the Faculty of Dentistry, Obafemi Awolowo University, Ile-Ife, Osun –State, Nigeria.

**** Foluso John Owotade BCH.D, FWACS Department of oral and maxillofacial surgery, the Faculty of Dentistry, Obafemi Awolowo University, Ile-Ife, Osun –State, Nigeria.

Send all correspondence to: Dr E.O Oziegbe, Department of child dental health, Faculty of Dentistry, Obafemi Awolowo University, Ile-Ife, Nigeria

E-mail: elioziegbe@yahoo.com

tive clinically healthy babies, infants and preschool children from the immunization clinics at the community health center (Eleyele Comprehensive Health Center and Enuwa Comprehensive Health Center) in Ife Central and Ife East Local Government Areas. These children were randomly selected from the four Local Government Areas in Ile-Ife, Osun State, Nigeria between January 2006 and July 2006. The comprehensive health centers provide immunization and health care services for children less than 16 years of age in Ile-Ife.

All the children selected in the sample met the following criteria:

1. Children within the age group of 4-36 months
2. Informed consent, freely provided by these children's parents as recommended by the ethical principles of the World Medical Association and by the ethical committee of the Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife, Nigeria.
3. Children who were Nigerians (Father and Mother were Nigerians).
4. Full term and clinically healthy

For the purpose of this study, an erupted tooth was defined as any tooth with any part of its crown penetrating the gingiva and visible in the oral cavity.¹⁰ Extracted tooth/teeth were regarded as having emerged. An assistant recorded the data. The teeth were recorded in the Fédération Dentaire Internationale (FDI) nomenclature.

Table I. Mean eruption age (months) of each maxillary and mandibular primary tooth in Boys and Girls.

Boys							
Tooth	Right Mean (months)	SD	Tooth	Left Mean (months)	SD	t	p
51	9.33	1.88	61	9.24	1.95	0.75	0.45
52	12.03	2.91	62	11.93	3.59	0.49	0.62
53	17.89	4.00	63	17.75	4.05	0.56	0.58
54	16.05	2.91	64	16.01	3.16	0.21	0.83
55	26.17	5.52	65	26.05	5.80	0.34	0.73
81	7.55	1.79	71	7.55	1.79	0.00	1.00
82	12.41	3.74	72	12.42	3.49	0.04	0.97
83	18.47	4.17	73	17.91	3.86	2.23	0.03*
84	16.34	3.06	74	16.19	3.06	0.79	0.43
85	24.12	5.52	75	24.13	5.58	0.03	0.98

Girls							
Tooth	Mean	SD	Tooth	Mean	SD	t	p
51	10.08	2.53	61	10.03	2.54	0.31	0.76
52	12.92	3.36	62	12.95	4.57	0.12	0.91
53	18.22	4.10	63	18.32	4.20	0.38	0.70
54	16.02	2.91	64	15.96	2.85	0.33	0.74
55	26.13	4.95	65	26.09	5.12	0.13	0.90
81	7.92	2.77	71	7.84	2.14	0.51	0.61
82	12.94	2.84	72	13.02	3.14	0.42	0.67
83	18.72	3.93	73	18.82	4.03	0.40	0.69
84	16.01	3.14	74	15.99	3.21	0.10	0.92
85	24.06	4.71	75	24.34	4.63	0.88	0.38

* Significant value

Statistical analyses were performed with STATA (Inter-cooled release 9) for windows. The age of eruption was estimated using the technique described by Hayes and Mantel³⁰ (1958) and Cox and Hinkley.³¹ Mean age (in months) and standard deviation were determined by the above method and compared using *t* tests. Statistical significance was defined at $p < 0.05$.

RESULTS

A total number of 1,013 children met the inclusion criteria for this study. The age ranged from 4 to 36 months with the mean age being 19.04 ± 9.34 months. There were 514 boys (50.7%) and 499 girls (49.3%).

Generally, the teeth on the left side erupted earlier than on the right side in boys, but the differences noted were not statistically significant except for the mandibular left canine which erupted significantly earlier on the left side in boys. ($p=0.03$). In girls, no discernible pattern was noted. (Table I)

Boys showed an earlier eruption time with the mean eruption age of the primary incisors and mandibular primary canine being significantly earlier in boys than girls ($p < 0.05$). Table II shows the combined mean eruption age of deciduous teeth for boys and girls. The sequence of eruption of deciduous teeth was: Mandibular central incisor (7.72 ± 2.19), Maxillary central incisor (9.67 ± 2.31), Maxillary lateral incisor (12.46 ± 3.95), Mandibular lateral incisor (12.72 ± 3.33), Maxillary first molar (16.01 ± 2.96), Mandibular first molar (16.13 ± 3.14), Maxillary canine (18.05 ± 4.09), Mandibular canine (18.49 ± 4.00), Mandibular second molar (24.17 ± 5.13) and finally Maxillary second molar (26.12 ± 5.37) (Table II).

The length of time (months) from the mean eruption time of the first tooth to the mean eruption time of the last tooth for both genders was 16.43 and 16.42 months in the maxillary right and left sides respectively; and 16.36 and 16.54 months, in the mandibular right and left sides respectively. (Table III).

Four active phases of tooth eruption have been identified: incisor eruption, first molar eruption, canine eruption, and

Table II. Mean eruption age (months) of maxillary and mandibular primary teeth in Boys and Girls.

Tooth	Boys		Girls		P	Boys and Girls combined	
	Mean	SD	Mean	SD		Mean	SD
51,61	9.29	1.92	10.06	2.54	0.000*	9.67	2.31
52,62	11.98	3.27	12.94	4.01	0.000*	12.46	3.95
53,63	17.82	4.03	18.27	4.16	0.081	18.05	4.09
54,64	16.03	3.04	15.99	2.88	0.830	16.01	2.96
55, 65	26.11	5.66	26.11	5.04	1.000	26.12	5.37
81,71	7.55	1.80	7.88	2.48	0.015*	7.72	2.19
82,72	12.42	3.61	12.98	2.99	0.007*	12.72	3.33
83,73	18.19	4.03	18.77	3.98	0.021*	18.49	4.00
84,74	16.27	3.06	16.00	3.17	0.168	16.13	3.14
85,75	24.13	5.55	24.20	4.67	0.828	24.17	5.13

* Significant values

Table III. Duration of eruption (months) from the first tooth to the last tooth to emerge per quadrant in Boys and Girls.

Quadrant	Boys	Girls	Boys and Girls combined
Upper right	17.84	16.05	16.43
Upper left	16.81	16.06	16.42
Lower right	16.57	16.14	16.36
Lower left	16.58	16.50	16.54

Table IV. Distribution according to phases of eruption (months).

Phase of Eruption	MAXILLA			MANDIBLE		
	Boys	Girls	Both	Boys	Girls	Both
Phase 1-phase 2	4.05	3.05	3.28	3.85	3.02	3.41
Phase 2-phase 3	1.79	2.38	2.04	1.92	2.77	2.36
Phase 3-phase 4	8.29	7.84	8.07	5.94	5.43	5.68

second molar eruption. Although boys showed an earlier eruption, a catch-up by girls was noted during the eruption of the lateral incisors and the first molars. (Tables II and IV).

Table V shows a country-based comparison of mean eruption age for Nigerian, Iraqi, Saudi Arabian, Icelander and USA children. Children in this study have a lower mean eruption age when compared to their Middle East and American counterparts but a higher mean eruption age when compared to their counterparts from Iceland.

DISCUSSION

The mean eruption age of primary teeth has been determined for most population groups with differences in timing of emergence. This is apparently due to possible variations in the genetic constitution and the environment of the groups studied.

Many authors^{10,11} believed there are no differences in the

eruption times of corresponding teeth on the right and left sides of the jaws. In this study, there was a tendency towards earlier eruption on the left side compared to the right side in boys; however, these differences were not statistically significant except for the mandibular left canine in boys. There was no discernible pattern in girls. In an earlier study¹³ in Nigerian children, no report was made on the comparison of the mean eruption age of corresponding teeth on right and left sides. The reason for the systematic tendency towards earlier eruption on the left side in this study is not clear; hence, further studies are necessary.

Gender differences in the emergence of primary teeth are not clearly established in the literature.¹² While some authors^{11,19} reported significant earlier eruption in girls compared to boys; others have reported earlier eruption in boys.^{6,10,12,20,21,29} Other authors^{13,22,23-26} have reported no gender difference in the timing of emergence of primary teeth. In this study, maxillary and mandibular primary teeth erupted earlier in boys than girls with the exception of the first molars. Previous studies³² reported as the reason an accelerated growth in boys during the first trimester. A genetic and molecular based study should be performed to confirm this finding.

In this study, the first molar eruption was earlier in girls than boys. These findings, although similar to those of Tanguay *et al*¹² and Robinow *et al*¹⁸ contradict the Saudi Arabian study¹⁰ where the maxillary first molar emerged earlier in boys. The reason for the notable exception of the first molars erupting earlier in girls cannot be attributed to either physiological or embryological factors and neither could it be due to sampling error because of the large sample size used in this study. The sequence of eruption in this study is similar to the findings of other studies.

The children completed the first phase of eruption within 5 months, followed by a resting interval of about 3.4 and 3.3

Table V. Mean eruption age (months) of maxillary and mandibular primary teeth in boys and girls in various countries

Tooth	NIGERIA (Present study)		SAUDI10		IRAQ10		ICELAND11		USA10	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
51,61	9.29***	10.06***	11.19**	11.20**	10.70**	10.60**	8.99*	9.21*	9.36**	8.76*
52,62	11.98***	12.94***	13.09**	13.31**	10.10*	11.40*	10.38*	10.16*	12.00**	11.76*
53,63	17.82***	18.27***	21.14**	21.03**	18.80**	19.90**	17.59*	17.98*	21.00**	20.76**
54,64	16.03***	15.99***	16.88**	16.90**	16.30**	16.40**	15.10*	14.95*	17.52**	16.32**
55,65	26.11***	26.11***	28.16**	28.25**	26.00*	27.00**	26.13**	25.11*	30.96**	31.44**
81,71	7.55***	7.88***	8.44**	8.49**	9.20**	8.40**	8.03**	6.89*	7.20*	7.68*
82,72	12.42***	12.92***	14.44**	14.61**	14.00**	14.30**	12.08*	11.75*	13.08**	13.32**
83,73	18.19***	18.77***	21.03**	21.10**	19.00**	20.30**	19.16**	18.14*	20.88**	20.52**
84,74	16.27***	16.00***	17.17**	17.13**	16.90**	17.00**	16.16*	15.43*	16.56**	16.44**
85,75	24.13***	24.20***	27.92**	27.97**	26.00**	25.10**	25.62**	23.74*	30.00**	29.52**

Color codes

- * - Values less than current study
- ** - Values greater than current study.
- *** - Current study.

months in the mandible and maxilla respectively before the eruption of the first molars (phase 2). A resting period of 2.4 months in the mandible and 2.0 months in the maxilla was noted between phase 2 and phase 3 (eruption of canine). The last phase, eruption of the second molars, occurred after an interval of 5.7 and 8.0 months in the mandible and maxilla respectively. Al-Jasser and Bello¹⁰ observed that Saudi Arabian children completed the first phase of tooth eruption within 6 months. Magnusson¹¹ however, observed that this same period was completed within 4 months in boys and almost 5 months in girls from Iceland. The resting interval between phase 2 and phase 3 was longer in the Saudi Arabian¹⁰ and Icelandic children¹¹ when compared to the Nigerian children. The resting interval between phases 3 and 4 was shorter in the Nigerian children when compared to their Saudi Arabian and Icelandic counterparts except in the maxilla where it was shorter for Saudi Arabian children. The variation noted could be due to genetic and ethnic differences.

Girls had shorter quiescent periods between phases 1 and 2 as well as phases 3 and 4 in both the mandible and maxilla when compared to boys. However, boys had a shorter resting interval between phase 2 and 3 in both arches when compared to girls. This may explain the catch-up noticed in the eruption time of girls compared with boys where girls completed eruption almost at the same time as boys. The catch-up in eruption with the boys occurred around the quiescent period between phase 1 and phase 2 (Table IV). This is similar to the findings of Infante.³³ Burdi, Garn, and Miller have explained the reason for the boys' advantage in the early stages of dental development.³⁴ They reported that girls, normally behind in relation to boys during intrauterine development remain so through the time of eruption of lateral incisors. Girls then catch up to be ahead in dental development and remain ahead through the completion of primary teeth emergence as well as exfoliation³⁵ and permanent tooth eruption.³⁶ However, no published data exists on primary teeth phases of eruption in Nigerian children.

The duration of eruption (from first tooth to last tooth to emerge) is shorter in girls when compared to boys in this study. This is similar to what was observed in Icelanders.¹¹ The reason may be due to the above-mentioned explanation in mean age of eruption for gender differences. In general, the duration of eruption in Nigerian children is shorter when compared to that of Saudi Arabians.¹⁰ This is particularly more pronounced in Nigerian girls, displaying a later age of eruption by tooth when compared to the Icelanders. The reason could be genetic or environmental and therefore further research is needed.

When the mean eruption ages by tooth were compared with that of other nations, Nigerian children had an earlier eruption time in all primary teeth than their counterparts from the Middle East^{10,37} and in most primary teeth than children from the United States of America (USA).¹⁰ The Icelandic¹¹ and Japanese²² children showed an earlier mean age of emergence in most primary teeth when compared with the Nigerian children. However, a study of Negroid Americans

revealed earlier emergence times compared with their Caucasoid counterparts.³⁸ Another study among the British population showed earlier emergence times among Blacks when compared to their British counterparts.³⁹ This study also showed earlier emergence times of most primary teeth in black Nigerian children when compared to their Arab and American counterparts. This points to the possible influence of genetics as a strong factor in determining the timing of primary teeth emergence.

CONCLUSION

There was a systematic tendency for early eruption of left sided primary teeth in boys when compared to girls.

The eruption of maxillary and mandibular primary teeth occurred earlier in boys than girls, except for the first molars; however, girls had a shorter duration of eruption (from the first tooth to erupt to the last tooth to erupt) when compared to boys.

The sequence of eruption of primary teeth in this study was found to be the same as the one reported in recent literature.

The Nigerian children presented an earlier eruption of primary teeth when compared with their Arabian and American counterparts but a later than that of children from Iceland.

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