

Eruption Times And Sequence Of Permanent Teeth Among Ghanaian Children

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ABSTRACT

The objective of this study was to determine the eruption times and sequence of permanent teeth in Ghanaian children. Cross-sectional data on age-specific tooth eruption times was collected from first and second cycle school children 4 to 20 years in the Greater Accra Region in Ghana (1999). All children and adolescents (1094 girls and 999 boys) in four selected schools were examined. With the exception of the third maxillary molars, females erupted all teeth earlier than males. Generally, mandibular teeth erupted earlier than the maxillary teeth except for the premolars. The first permanent teeth to show in the oral cavity were the mandibular centrals and first molars both of which erupted at the mean age of 5.3 years (CI: 3.0, 6.4). The last teeth to erupt, the third molars, were erupted by age 19.1 years (CI: 18.0, 21.0). This study corroborates an earlier Ghanaian study where eruption times were same or 3-5 months earlier. Both Ghanaian studies, however, show earlier eruption times in comparison with those in Caucasian children from temperate climates.

KEYWORDS: tooth eruption; permanent teeth; Ghanaian children.

INTRODUCTION:

The only available study of the eruption pattern of permanent teeth of Ghanaian children was carried out in 1964¹. This reported an eruption times and sequence which have since not been verified. With recent emphasis on evidence-based dentistry and since the opening of the University of Ghana Dental School, interest has been expressed for new data to corroborate this earlier study. As dental awareness gradually increases among the population, there will be the need to provide accurate information to parents who may inquire about the right times for the eruption of their children's teeth. Standardized data of tooth eruption are very essential in child care planning, clinical dentistry, orthodontics and in the diagnosis of certain growth disturbances.

The aim of this study was therefore to determine the mean age of emergence of the individual permanent teeth in Ghanaian children.

METHOD

Three Primary Schools, (ages 4 to 15 years), and

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one Secondary School, (ages 16-20 years were selected in the Mamprobi area in the Ablekuma District of the Greater Accra Region, Ghana, and examined for their caries and periodontal disease prevalence. These schools were selected because they represented middle income, peri-urban communities. Past Ghanaian caries studies have shown moderate caries rates in urban communities and low rates in rural areas^{2,3}. It was therefore felt that a middle income area would provide results close to the values of the "average Ghanaian". School authorities selected these "middle income, peri-urban schools" in consultation with the Department of Community and Preventive Dentistry at the University of Ghana Dental School.

Every child in the four selected schools was examined (census survey) and all teeth present in the mouth were recorded for each student. This was because school authorities felt some parents would be very unhappy if their children were left out of the school examinations. The tooth counts and recordings were done by a Lecturer and six final year dental students who had been calibrated at the University of Ghana Dental School.

A tooth was counted as erupted if part of the crown had pierced through the gingiva and was visible.

Examinations were done according to the WHO Basic Methods (1997)⁴ by the visual method with a mouth mirror under bright sunny conditions at the respective school compounds. The data was entered in Excel and analyzed with SPSS Windows (Version 6.1). The eruption sequence of the permanent teeth was then calculated using probability transformations or probit analysis. For each tooth and sex, the percentage of children in whom the tooth was present at age-specific levels was determined. The percentages for the right and left sides were then combined and transformed to probability ("probit") values for each age group. Finally the probit values were plotted against age for each sex and a linear regression line was fitted through the plotted points. The average or mean eruption time was then read from the graph horizontal age scale as a projection of the probability value 5 (50%; Figure 1). Standard deviations and 95% confidence intervals (CI) were obtained from the graphs.

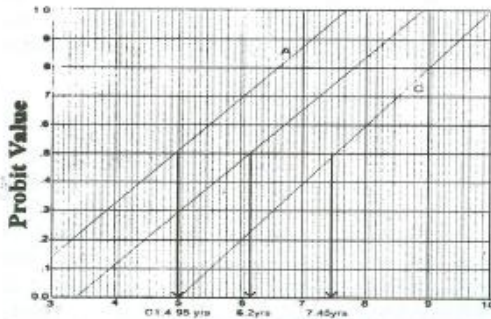


Figure 1: Graph showing average Eruption Time for the maxillary central in females from the horizontal age scale as a projection of the probit 5

RESULTS

The total number of children examined was 2093, with 1094 girls and 999 boys. Table I shows the distribution of the sample by age and sex.

Table 1: Age and Sex Distribution of Sample

AGE (Years)	male	Female	Total
4	43	69	112
5	120	123	243
6	62	64	126
7	78	101	179
8	100	63	163

(Years)	male	Female	Total
9	94	98	192
10	77	74	151
11	72	71	143
12	62	45	107
13	74	85	159
14	80	73	153
15	42	52	94
16	13	16	29
17	12	32	44
18	29	76	105
19	31	39	70
20	10	13	23
Total.....	999.....	1094.....	2093

Table 2 shows the mean eruption ages of all permanent teeth in the population studied.

Table 2: Eruption pattern of permanent teeth in school children in Accra, Ghana (1999)

Mandible					
Tooth	Male (SD)	CI	Female (SD)	CI	
41-31	5.7 +/- 0.6	3.9, 6.7	5.3 +/- 0.6	3.0, 6.3	
42-32	6.8 +/- 0.5	6.1, 7.7	6.3 +/- 0.5	6.0, 6.6	
43-33	9.9 +/- 0.6	9.5, 10.3	9.2 +/- 0.5	8.6, 9.7	
44-34	10.1 +/- 0.5	9.5, 10.6	9.6 +/- 0.5	8.5, 10.4	
45-35	10.8 +/- 0.6	10.5, 11.0	10.2 +/- 0.5	9.7, 10.7	
46-36	5.8 +/- 0.5	4.1, 6.8	5.3 +/- 0.6	3.0, 6.4	
47-37	11.5 +/- 0.6	11.0, 12.1	10.7 +/- 0.6	10.1, 11.2	
48-38	17.8 +/- 0.9	16.9, 19.1	17.5 +/- 0.9	16.7, 18.6	
Maxilla					
Tooth	Male (SD)	CI	Female (SD)	CI	
11-21	6.7 +/- 0.5	6.0, 7.4	6.2 +/- 0.5	5.7, 6.6	
12-22	7.7 +/- 0.4	7.1, 8.3	7.4 +/- 0.5	6.4, 8.2	
13-23	10.7 +/- 0.6	10.4, 11.0	9.8 +/- 0.6	8.5, 10.7	
14-24	9.7 +/- 0.4	9.3, 10.1	9.4 +/- 0.5	8.9, 9.8	
15-25	10.8 +/- 0.6	10.4, 11.1	10.2 +/- 0.5	9.7, 10.6	
16-26	6.1 +/- 0.5	5.1, 6.9	5.8 +/- 0.6	4.8, 6.4	
17-27	11.9 +/- 0.6	11.3, 12.6	11.2 +/- 0.6	10.5, 11.8	
18-28	18.9 +/- 1.1	17.9, 20.3	19.1 +/- 1.2	18.0, 21.0	

The permanent teeth begin to erupt at the mean age of 5.3 years (CI: 3.0, 6.3) and are completed by the age of 19.1 years (CI: 18.0, 21.0). With the exception of the premolars, the permanent mandibular teeth erupt at an earlier age than the maxillary teeth (Table 2). Although the second premolars erupted at about the same time in both arches, the maxillary first premolars erupted earlier than the mandibular counterparts.

The permanent teeth in females erupted, on the average, 2-9 months earlier than in males (Table 2, Fig. 2). The exception was with the maxillary third molars which emerged earlier in males. The third molars, both in the lower and the upper jaws, started erupting as early as age 13 years in females and 15 years in males.

Although the mean eruption time for cuspids appeared to be from 9-10 years maxillary cuspids in males erupted from 10-11 years at about the same time as the second premolars.

The mandibular central incisors and first permanent molars in the females erupted at the same mean age of 5,3 years (CI: 3.0, 6.3) (Table 2; Fig.3). In the male the mandibular central incisors erupted earlier than the first permanent mandibular molar although this time lag was not statistically significant ($p > 0.05$) (Table 2). The maxillary first permanent molar in females and the first mandibular molar in males erupted at about the same mean age of 5.8 years (CI: 4.1, 6.8). In both sexes, however, the first permanent maxillary molars erupted earlier than the maxillary central incisors. Table 3 shows some eruption patterns among the children in this study and how surprisingly early the permanent teeth erupt at the various ages.

Table 3 -. Maximum Number of Teeth Erupted At Various Ages

At 4 years, there was a maximum of 6 permanent teeth
 At 5 years, there was a mode of 4 and a maximum of 10 permanent teeth
 At ages 6-7 years, there was a mode of 6 teeth and a maximum of 12 permanent teeth
 At age 8, there was a mode of 12 teeth and a maximum of 14 permanent teeth
 At age 9, there was a mode of 12 teeth and a maximum of 24 permanent teeth
 At ages 10-16, 22.7% had a mode and a maximum of 28 permanent teeth
 At ages 13-16 years 0.3% had all 32 permanent teeth erupted with a mode of 28 teeth.

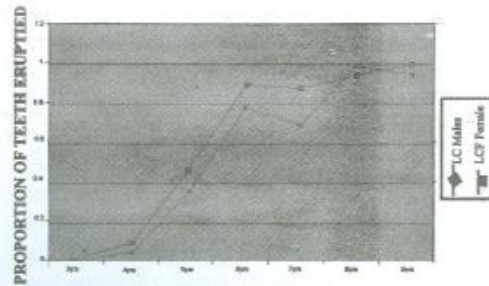


Figure 2: Eruption times by sex— lower central incisors

DISCUSSION

Caries prevalence analysis of this population data showed that most of the caries in the school children were untreated. From this study a negligible 0.1% of the population examined had ever seen a dentist. This therefore eliminated the known effect that premature loss of deciduous teeth would have on the eruption of the succedaneous permanent teeth.

The main differences between this study and the 1964 study¹ are (Tables 2 , Figure 3)

1. The mandibular central incisors and permanent first molars erupted at approximately the same time in this study. In the 1964 study the mandibular central incisors erupted after both mandibular and maxillary first permanent molars.
2. In this study the maxillary first premolars and lower cuspids erupted at about the same time as did the upper and lower second premolars. In the previous study the maxillary first premolars erupted before the lower cuspids. Also, the maxillary second premolar erupted earlier than the lower second premolars.
3. Generally the eruption times in the present study were the same or just slightly later ($p > 0.05$) than in the earlier study.

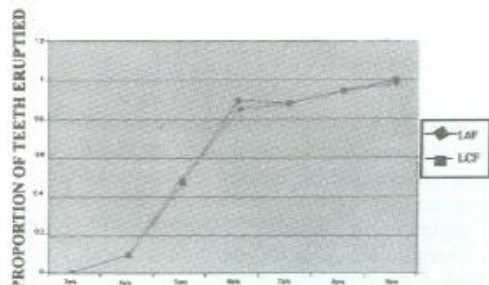


Figure 3: Eruption sequence by sex and tooth type lower first perm. molars vs lower central incisors

Table 5: Comparison Of Mean Age Of Eruption (Years) Of Permanent Teeth In Various Countries

TOOTH	SEX	Ghana ⁷ 1964	*Ghana 1999	North. Ireland ⁷ 1998	Canada ⁵ 1950	United States ⁶ 1962
Mandible						
1	F	5.1	5.3	6.3	5.5	6.26
	M	5.3	5.7	6.3	6.1	6.54
2	F	6.4	6.3	7.4	6.9	7.34
	M	6.1	6.8	7.4	7.3	7.7
3	F	8.9	9.2	9.9	9.6	9.86
	M	10.0	9.9	10.6	10.7	10.79
4	F	9.2	9.6	10.4	10.2	10.18
	M	9.8	10.1	10.7	10.8	10.82
5	F	10.3	10.2	11.4	11.1	10.89
	M	10.6	10.8	11.5	11.7	11.47
6	F	4.5	5.3	6.3	5.8	5.94
	M	4.9	5.8	6.4	6.2	6.21
7	F	10.5	10.7	11.9	11.5	11.66
	M	10.8	11.5	11.8	12.0	12.12
8	F	—	17.5	—	—	—
	M	16.5	17.8	—	—	—
Maxilla						
1	F	6.0	6.2	7.1	6.5	7.2
	M	6.3	6.7	7.2	7.2	7.47
2	F	7.3	7.4	8.1	7.95	8.2
	M	7.5	7.7	8.3	8.3	8.67
3	F	9.5	9.8	11.0	10.6	10.98
	M	10.4	10.7	11.3	11.4	11.69
4	F	9.0	9.4	10.5	10.05	10.03
	M	9.5	9.7	10.8	10.5	10.4
5	F	10.0	10.2	11.2	11.2	10.88
	M	10.5	10.8	11.4	11.3	11.18
6	F	5.0	5.8	6.4	5.4	6.22
	M	5.0	6.1	6.4	6.1	6.4
7	F	10.9	11.2	12.1	12.3	12.27
	M	10.9	11.9	12.1	12.3	12.27
8	F	—	19.1	—	—	—
	M	16.7	18.9	—	—	—

*Present study

Generally the average male/female eruption time difference was 3 to 6 months with females showing an earlier eruption. Compared to Ghanaian children, the mean eruption times in the more temperate countries as in Canada⁵, United States⁶ and Northern Ireland⁷ are all later by about one year (Table 5).

Africans, African Americans and American Indians have been reported to be considerably more precocious dentally than European and American

whites^{7,8,9}. Although present study cannot provide reasons for this observation, the study by Houpt, Adu-Aryee and Grainger⁷ suggested that the difference in eruption times was a racial rather than an environmental characteristic. Besides genetic, sex, ethnic factors and premature extractions, other factors have been noted to influence eruption times. These include climate, socioeconomic factors, fluoride concentration, developmental syndromes and endocrine disturbances^{7,8,9}. The earlier Ghanaian study did not have an adequate sample size to make

Table 4 gives the eruption times of the permanent dentition from the two Ghanaian studies compared with those from other countries.

Generally the average male/female eruption time difference was 3 to 6 months with females showing an earlier eruption. Compared to Ghanaian children, the mean eruption times in the more temperate countries as in Canada⁵, United States⁶ and Northern Ireland⁷ are all later by about one year (Table 4). Africans, African Americans and American Indians have been reported to be considerably more precocious dentally than European and American whites^{7,8,9}. Although present study cannot provide reasons for this observation, the study by Houpt, Adu-Aryee and Grainger suggested that the difference in eruption times was a racial rather than an environmental characteristic.

Besides genetic, sex, ethnic factors and premature extractions, other factors have been noted to influence eruption times. These include climate, socioeconomic factors, fluoride concentration, developmental syndromes and endocrine disturbances^{7,8,9}. Eruption times and sequence of the third molars will be discussed in another paper. Unfortunately the earlier Ghanaian study did not have an adequate sample size to make any definite conclusions on third molars. Detailed discussion on the eruption times and sequence of the third molars will be presented in another paper. Eruption times and sequence of the deciduous dentition also need to be investigated since Ghanaian dentists are still using data in textbooks based on studies from Caucasian populations.

It may be argued that the inclusion of final year dental students, although calibrated, might tend to decrease reliability. The reliability study with Kappa value of 0.64 among the student examiners is quite within acceptable examiner variation limits¹⁰, given that the more difficult caries and periodontal indices were used for the calibration exercise. It was felt that with counts of erupted teeth that the reliability would be higher with final year dental students. With more intensive calibration exercises the use of dental students in the African region would be an efficient practice since experienced manpower and funds for epidemiological studies are presently of very limited supply.

CONCLUSION

Present study corroborates an earlier Ghanaian study where eruption times were similar or 3-5 months sooner. Both Ghanaian studies, however, show earlier eruption times in comparison with Caucasian children from temperate climates.

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