

Eruption time of permanent first molars and incisors among a sample of Saudi male schoolchildren

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هدفت هذه الدراسة إلى تحديد زمن بزوغ الأرحاء الأولى الدائمة والقواطع المركزية والجانبية ومقارنة زمن البزوغ مع كتلة الجسم بشكل عام، وذلك عند عينة من السعوديين الذكور في مرحلة الحضانة والمرحلة الابتدائية من الصف الأول إلى الثالث. جرى عشوائياً اختيار 716 من السعوديين الذكور. جرى تسجيل زمن بزوغ الأرحاء الأولى الدائمة والقواطع المركزية والجانبية إضافة إلى العمر والوزن والطول. بلغ متوسط عمر الأطفال حوالي 81.5 ± 10.9 شهراً حيث تراوح العمر ما بين 61 إلى 111 شهراً. دلت النتائج على أن بزوغ الأرحاء العلوية الأولى الدائمة كانت الأبعد بمتوسط عمر 94.1 ± 8.3 شهراً، والقواطع الجانبية العلوية اليمنى كانت آخرها بزوغها بمتوسط عمر 88.4 شهراً فكانت الأرحاء الأولى الدائمة بازغة عند حوالي 97% من الأولاد. لم يلاحظ وجود أية علاقة ما بين زمن البزوغ وكتلة الجسم بشكل عام. باستثناء السن رقم 32. وعلى الرغم من ذلك فيبدو أنه توجد علاقة عكسية بين زمن البزوغ وكتلة الجسم بشكل عام. وعند إجراء مقارنة بين نتائج هذه الدراسة ودراسات أخرى أجريت على الذكور، لوحظ تأخر في زمن البزوغ مقارنة مع الدول الأفريقية، بينما كان زمن البزوغ أبكر مقارنة مع استراليا وإيران بالنسبة للأرحاء الأولى الدائمة والقواطع المركزية والجانبية.

The objectives of the present study were to determine the mean eruption time of permanent first molars, central and lateral incisors and to compare the relationship of eruption time with Body Mass Index (BMI) in Saudi male preschool and primary schoolchildren of grade 1 to grade 3 (G1 to G3). The study population comprised 716 randomly selected male preschool and primary school children from G1 to G3. The eruption time of permanent first molars, central and lateral incisors with age, height and weight were recorded. The mean age of children was 81.5 ± 10.9 months ranging from 61 months to 111 months. The results show that, maxillary right first molar had the lowest mean eruption time of 70.2 ± 5.3 months and the right upper lateral incisor was the last tooth to erupt with mean eruption time of 94.1 ± 8.3 months. Furthermore, the mandibular incisors erupted significantly earlier than maxillary incisors. By the age of 88.4 months, 97% of the boys had all their first permanent molars erupted. There was no significant correlation observed between eruption times with BMI, except for tooth # 32. Nevertheless, it seems that an inverse relationship may exist between the eruption time and BMI. When comparing with the reported results of other national studies, the Saudi male children showed later eruption time than some of African countries and earlier eruption than Iranian and Australian children of permanent first molars, central and lateral incisors.

INTRODUCTION

Parents consider tooth eruption as an important event in the child's development, and they have often showed their concern about the timing of eruption of teeth. Mostly the information on the age of permanent teeth emergence used in clinical and academic studies in Saudi Arabia is based on American and

European standards.^{1,2} However, 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 emergence may vary considerably in both dentitions.³ Similarly, adequate knowledge of timing of permanent tooth emergence is essential for diagnosis and treatment planning in pediatric dentistry and orthodontics.⁴ Furthermore, information on tooth emergence is also used to supplement other maturity indicators in the diagnosis of certain growth disturbances, and in forensic

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dentistry to estimate the chronological age of children with unknown birth records.⁴⁻⁶ Therefore, the specific standards on the timing and sequence of emergence of the permanent teeth represent an important resource for general dental practitioners and specialists involved in managing dental problems in growing children.⁷

Eruption time of permanent teeth has been studied among different populations and among different ethnic groups.^{4,7-24} These studies showed that variation exists in the eruption times of permanent teeth, and this may be attributed to numerous racial differences.^{9,10,12,25} It has also reported that some other variables like genetic and hormonal factors,^{26,27} geographical, ethnic, gender, as well as economic status and nutrition and growth parameters have been shown to exert influences on eruption times and emergence.^{6,9,10,13,14,28} Few studies have also reported a relationship between the eruption time, with the weight and height of children. Children who are below average weight and height showed a later eruption time than those children who are within the standard range.^{9,25} In the literature review, a recent study was found on the eruption times of primary dentition in Saudi children.²⁹ However, there is no information available on the eruption time of permanent dentition in Saudi children. Therefore, the present study was conducted among male preschool and primary schoolchildren of G1 to G3 to establish this norm. The objectives of the present study were to determine the mean eruption time of permanent first molars and incisors, and to compare the relationship of the eruption time with BMI.

SUBJECTS AND METHOD

The population used for this cross-sectional study comprised male preschool children of Riyadh and G1 to G3 primary

school children of Riyadh and Jeddah. Three private kindergarten schools, three governmental primary schools and one private primary school were selected from Riyadh. Furthermore, two governmental primary schools were selected from Jeddah. List of schools were obtained from Ministry of Education of Riyadh and Jeddah. Schools were randomly selected from western, central and eastern part of Riyadh and in the northern and southern part of Jeddah. One private school was selected randomly from the list of private schools. All the children from preschool and G1 to G3 of the selected schools were screened and the children who fulfilled the inclusion criterion of just erupted tooth were subjected for further examination. The criterion for just erupted tooth was defined as: a tooth deemed to have emerged if any part of it was visible in the mouth.⁵ A total of 2443 children were examined (1590 from Riyadh and 853 from Jeddah) and only 716 children were found suitable for the study. The data were collected over a period of one calendar month. All the selected children in the sample were Saudi national.

Prior to the commencement of the study, permission was taken from Ministry of Education. Letters were sent to the respective heads of the schools stating the aims and objectives of the study. The basic information about the children such as age, educational level, date of birth, place of birth, and family name was recorded on the especially designed form taken from their personal files in the school record. The children were weighed in kilograms using a weighing scale after removal of the shoes only. The height of the children was measured using a wall-mounted tailor tape on the child's head with their back and knees completely straight, and their feet together. The height was then rounded to the nearest centimeter. Clinical examination was done using a wooden spatula to retract

soft tissue, and the status of eruption of the permanent tooth was recorded.

The data were then entered into the computer utilizing the Statistical Package of Social Science (SPSS version 10). Descriptive statistics (minimum, maximum, mean, standard deviation, median and range) of eruption time was computed for each tooth. Different percentiles (P3, P10, P25, P50, P75, P90 and P97) of the eruption time of permanent teeth were also calculated. BMI was calculated using the following formula

$$\text{BMI} = \frac{\text{Weight (kg)}}{[\text{Height (m)}]^2}$$

t-test was used to compare the mean eruption time of Riyadh and Jeddah children. Furthermore, *t* test was also used to compare the difference between mean eruption time of upper with lower and right with left of the corresponding teeth. Pearson correlation was utilized to find the correlation between eruption time and BMI.

RESULTS

The mean age of 716 children was 81.5 ± 10.9 months (R: 61.3-110.9 months). The mean eruption time of the boys of the two cities was not significantly different for any tooth except maxillary central incisors, and there was no systematic trend in the mean ages, therefore, the data were joined together for further analysis. Table 1 shows the descriptive statistics (minimum, maximum, mean, standard deviation, median and range) of eruption time of permanent first molars, central and lateral incisors. The results showed that maxillary right first molar (# 16) had the lowest eruption time of 70.2 ± 5.3 (R: 61.3-81.7) months and mandibular left first molar (# 36) had the

Table 1. Descriptive statistics of eruption time (months) of molars

Tooth number	Number of cases	Minimum	Maximum	Mean	SD	Median	Range
16	28	61.3	81.7	70.2	5.3	70.5	20.4
12	48	69.1	110.9	94.1	8.3	94.3	41.8
11	99	67.1	108.9	84.7	8.7	84.8	41.8
21	97	67.1	108.9	83.6	8.3	82.7	41.8
22	59	69.1	110.9	91.1	7.9	90.5	41.8
26	32	61.3	85.6	72.8	5.9	72.0	24.3
36	135	61.3	93.4	71.7	7.4	70.0	32.1
32	146	70.0	106.0	87.9	8.2	87.5	36.0
31	153	61.3	102.1	77.5	7.7	76.8	40.9
41	180	61.3	100.2	76.5	7.8	74.9	38.9
42	143	70.0	106.0	87.7	7.5	88.5	36.0
46	122	60.3	99.2	72.0	7.5	71.0	37.9

second lowest mean value of 71.7 ± 7.4 (R: 61.3-93.4) months. The difference of these two means was only 1.5 months. The left and right maxillary lateral incisors were the last teeth to erupt in our sample with mean values of 91.1 ± 7.9 (R: 69.1-110.9) months and 94.1 ± 8.3 (R: 69.1 – 110.9) months, respectively. The minimum range of variation of eruption (20.4 months) was seen in the maxillary right first molar (# 16); the maximum range of variation (41.8 months) was seen in all four maxillary incisors.

There was no significant difference observed between the mean eruption times of left and right molars or incisors ($P > 0.05$). However, the mean eruption time of maxillary and mandibular incisors (central and lateral) were statistically significant from each other ($P < 0.05$) as shown in Figure 1.

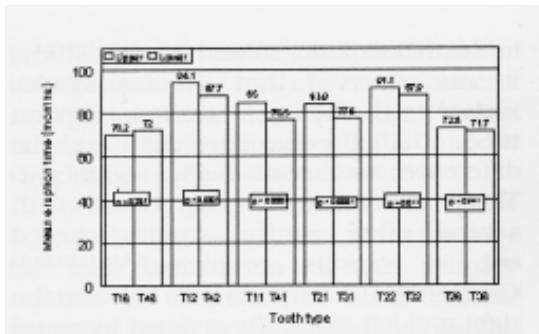


Fig 1. Comparison of mean eruption time of upper and lower teeth.

Table 2. Percentiles (3rd, P10, 25th, 75th, 90th and 97th) for eruption time (months) for boys.

Tooth number	P3	P10	P25	P75	P90	P97
16	61.3	62.2	66.4	74.4	77.9	81.7
12	73.2	82.5	89.5	100.2	105.1	108.6
11	69.1	73.9	77.8	90.5	97.3	102.1
21	69.9	72.9	77.1	89.2	94.3	101.6
22	74.5	80.7	85.6	96.3	101.2	107.0
26	61.3	63.1	70.0	75.6	81.8	85.6
36	61.3	62.2	67.1	76.8	84.0	88.4
32	74.9	76.8	81.7	93.4	99.5	104.2
31	66.7	69.1	72.0	81.2	88.5	95.7
41	62.2	69.1	71.0	80.7	88.5	95.5
42	74.2	77.8	81.7	91.4	98.4	102.8
46	61.3	63.2	66.1	76.8	84.6	87.8

Table 2 discusses 3rd, 10th, 25th, 75th, 90th and 97th percentile of the eruption time. Three percent (3%) of the boys had their upper right central incisor (#11) erupted by the age of 69.1 months. By the age of 108 months at least 97% of the boys had all their four central incisors erupted. In addition, the first four permanent molars erupted between the ages of 61.3 and 88.4 months in 94% of the boys. The correlation of BMI and

Table 3. Correlation of eruption time of first molars and incisors of boys with their BMI

Tooth type	Pearson correlation		
	n	R	p-value
16	28	-0.304	0.116
12	48	0.035	0.813
11	99	0.018	0.862
21	96	0.003	0.976
22	59	-0.022	0.871
26	32	-0.186	0.307
36	135	-0.110	0.204
32	146	-0.190	0.022*
31	153	-0.062	0.449
41	160	-0.148	0.063
42	143	-0.083	0.322
46	122	0.023	0.801

the eruption times is illustrated in Table 3. There was no statistically significant correlation found between these two features except for tooth # 32. However, there were more negative correlations than positive ones, which show that there may be an inverse relationship between eruption time and BMI. Table 4 illustrates the comparison of our data with male children from South Africa, Ghana, Nigeria, Japan, USA, Australia and Iran. It can be seen that the eruption time of permanent teeth of Ghana, and South African children was earlier than Saudi children. The Iranian and Australian children showed later eruption time than Saudi children. However, Nigerian, Japanese and USA children showed late eruption for maxillary teeth, but early eruption for some of the incisors when compared to Saudi children.

Table 4. Mean tooth eruption time (months) of permanent first molars, central incisors and lateral incisors in various countries

Tooth#	South Africa	Ghana	Nigeria	Japan	USA	Australia	Iran	Saudi Arabia
16	63	60	75	-	76	79	82	70.2
12	84	89	99	98	103	102	113	94.1
11	72	75	89	86	89	88	97	84.7
21	72	75	89	86	89	88	96	83.6
22	84	89	99	98	103	102	110	91.1
26	63	60	75	-	76	79	82	72.6
36	62	57	72	-	74	78	82	71.7
32	72	73	86	80	91	91	101	87.9
31	65	63	75	-	77	78	82	77.5
41	65	63	75	-	77	78	80	76.5
42	72	73	86	80	91	91	101	87.7
46	62	57	72	-	74	78	82	72.0

DISCUSSION

In the literature different population groups are targeted to determine the mean eruption times of the permanent teeth. However, there are no reported data available on eruption time of permanent teeth for Saudi population. Due to this reason, the standards for eruption times of permanent teeth were based on non-Saudi populations. This documented variation in eruption time values in different populations makes it necessary to investigate the normal values of eruption times for Saudi population. Therefore, the present study provides basic information on the mean eruption time of permanent first molars, central and lateral incisors in male Saudi preschool and primary school children of ages between 61 to 111 months. The result of this study showed that the mean eruption time of male children for the two cities (Riyadh and Jeddah) was not significantly different for any tooth except maxillary central incisors, and no systematic trend was observed in their mean ages. This fact indicates that there is no significant heterogeneity between Riyadh and Jeddah children

in tooth eruption times. In our study, it was observed that the mandibular incisor teeth had an earlier eruption time than the maxillary teeth and the difference was statistically significant. These results are in agreement with several other similar studies carried out in various countries.^{5,8,10,17,23,24,25} Comparing the eruption time between the right and left sides, the greatest temporal difference was seen in maxillary lateral incisors, which was about 3 months, followed by maxillary first molar, with a time difference of 2.6 months, which is not of great significance. Stewart *et al.*³¹ reported that these time differences are not systematic, and can be of any length between 4 months and 2 years.

The results of the present study did not reveal any significant correlation between BMI and eruption time except for left mandibular lateral incisor (# 32). However, more negative correlations than positive indicate an inverse relationship between BMI and eruption time. This finding is in agreement with Nishwander and Sujaku,²¹ who have reported that a trend was observed of general advancement in physical development with early eruption. Similarly, Hoffding *et al.*²² reported that only minor changes in tooth emergence was observed with pronounced acceleration in physical development.

Considering the permanent first molars, central and lateral incisors of these Saudi children, the mean eruption time was later than that reported in children from Ghana, and South Africa. Whereas the USA, Japanese and Nigerian children showed later eruption time than Saudi children for maxillary lateral teeth. However, Saudi children exhibited earlier eruption time than the Iranian and Australian male children. Several studies in various populations have thought that factors like nutrition, socio-economic status, genetics and geographic

location could have an influence on the emergence time of teeth.^{8,12,23,33,34} Clemens *et al.*²⁴ claimed in his study that mean emergence time was earlier in the children with higher socio-economic status.

The study was limited to the male school children, as it was conducted by the male dentists in all-male primary schools in deference to socio-cultural norms of Saudi Arabia. Nevertheless, the study has provided useful information about the mean eruption time of permanent first molars, central and lateral incisors in male preschool and primary school children of G1 to G3 of Riyadh and Jeddah.

CONCLUSIONS

- The maxillary right first molar and mandibular left first molar had the lowest eruption times of 70.2 months and 71.7 months, respectively. Whereas, the left and right maxillary lateral incisors were the last teeth to be erupted with mean values of 91.1 months and 94.1 months, respectively.
- The mandibular central and lateral incisors teeth erupted before the maxillary counterparts.
- There was no statistically significant difference observed in mean eruption times between left and right corresponding molars and central incisors.
- There may be an inverse relationship between BMI and eruption time.

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