

Permanent tooth eruption in Javanese children

Etty Indriati
Laboratorium Bioanthropology dan Paleoanthropology
Faculty of Medicine, Gadjah Mada University
Yogyakarta

ABSTRACT

Background: Permanent tooth eruption from the alveolus into the oral cavity is one of the basic growth and developmental processes in humans. The permanent tooth eruption occurs gradually with age and therefore the eruption schedule can be used as an age indicator in forensic cases where only skeletons and teeth of children have been found.

Objective: This study examines permanent tooth eruption in Javanese children and compares it with other populations.

Material and Method: The subjects were 175 children from the state elementary school of Imogiri II, Bantul District, Yogyakarta. Examinations were carried out using a mouth mirror under natural light. Data was classified in one-year age interval, based on the questionnaire given to parents to fill out with the birth date of each child. In addition, the mean and median ages of dental eruption in boys and girls maxillary and mandibular dentition were also statistically analyzed.

Results: Results show that in their maxillas, boys were more advanced than girls in tooth eruption, except for the upper canine teeth. Similarly, in the mandible, boys were more advanced than girls in tooth eruption, except for lower canine and second premolar teeth. In boys, the upper canines erupt later than upper second molars, which is opposite to the pattern of girls. The order of tooth eruption in boys is I₁-M₁, M¹, I¹, I₂, I², P₁, P¹, P₂, P², C₀, M₂, C⁰, M². In girls, the order of tooth eruption is I₁, M₁, M¹, I¹, I₂, I², P¹, P₁, C₀, P²-P₂, C⁰, M₂, M².

Conclusion: Age can be determined on the basis of tooth eruption in children and subadults.

Key words: permanent teeth, eruption, children, age, growth, Java

ABSTRAK

Latar Belakang: Erupsi gigi permanen dari alveolus ke dalam rongga mulut adalah satu proses pertumbuhan dan perkembangan pada manusia. Erupsi gigi permanen terjadi bertahap sejalan dengan usia dan oleh karenanya jadwal erupsi gigi dapat digunakan sebagai indikator umur pada kasus forensik di mana hanya rangka dan gigi anak ditemukan.

Tujuan penelitian: Untuk memeriksa erupsi gigi permanen anak-anak Jawa dan dibandingkan dengan jadwal erupsi gigi anak-anak populasi lain.

Bahan dan Cara: Subyek adalah 175 anak dari S.D. Negeri Imogiri II di Kabupaten Bantul, Yogyakarta. Pemeriksaan dilakukan dengan kaca mulut di bawah sinar alamiah (matahari). Data diklasifikasikan ke dalam 1 tahun interval, berdasarkan kuesioner yang diberikan kepada orang tua murid untuk mengisi tanggal lahir. Umur rata-rata dan umur median erupsi gigi pada anak laki-laki dan perempuan pada gigi maxilla dan mandibula juga dianalisa secara statistik.

Hasil: Hasil menunjukkan bahwa pada maxilla, anak laki-laki lebih dahulu bererupsi giginya, kecuali pada gigi caninus atas. Demikian pula pada mandibula, anak laki-laki lebih dahulu erupsi giginya daripada pada perempuan, kecuali pada gigi caninus dan premolar kedua bawah. Pada anak laki-laki, gigi caninus atas bererupsi lebih dulu dibanding molar kedua atas, polanya terbalik pada anak perempuan. Urutan erupsi gigi pada anak laki-laki adalah I₁-M₁, M¹, I¹, I₂, I², P₁, P¹, P₂, P², C₀, M₂, C⁰, M². Pada anak perempuan, urutan erupsi gigi permanennya adalah: M₁, M¹, I¹, I₂, I², P¹, P₁, C₀, P²-P₂, C⁰, M₂, M².

Simpulan: Umur bisa ditentukan berdasarkan waktu dan jenis erupsi gigi pada anak-anak.

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INTRODUCTION

Growth and development studies often use four indicators: dental formation and emergence, bone development, secondary sex traits, and stature or weight. As part of the growth indicators, dental formation and eruption have been widely studied in various human groups. Fels Research Institute at Yellow Springs, Ohio, for instance, studied dental formation extensively (Moorrees, *et al*^{1,2}). The duration of dental formation takes place over many years while dental eruption occurs during brief period. Dental eruption as a growth indicator can be used to determine the age of the individual in forensic cases where there are only children's skeletons and teeth are preserved. Children possess 20 deciduous or primary teeth, in which the roots of the deciduous teeth are resorbed with age, leaving only the crown until it is that will finally shed.

The shedding of deciduous teeth is followed by the emergence of permanent teeth for the continuity of the masticatory functions. Generally, humans possess 32 permanent teeth, but some individuals one have no anlage of the third molars and therefore only possess 28 permanent teeth. While deciduous teeth erupt from about 5 months to 24 months old postnatal in humans, permanent teeth erupt age about 5 1/2 years old up to 12-13 years old³. The dental formation (calcification) and dental eruption (emergence) at a particular time in subadult individuals enables us to use this biological phenomenon as age criterion, as evidenced by many reports^{1,2,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18, and 19}.

Permanent tooth eruption was studied extensively from in the 1920s up to 1950s and many studies were published in western scientific journals^{12,13,18,19,20,21,22,23,24,25,26,27,28,29, and 30}. Among these reports, the subjects studied were English children^{28 and 29}, Pima Indians²¹, Swedish³¹, and Other groups of caucasians^{12 and 13}. Reports on permanent tooth eruption in other populations appear scarce. In Indonesia, reports on dental eruption are especially lacking. The aim of this study is to examine the dental eruption among Javanese children aged 6 to 13 years old, by breaking the age down into one-year age intervals. In addition, the mean and median ages of tooth eruption will

also be analyzed to compare results of this study with those of others.

MATERIALS AND METHODS

The subject of this study was the state elementary school children of Imogiri II, Bantul, Yogyakarta. The subjects consist of 175 children, composed of 87 boys and 88 girls (TABLE 1). Questionnaires were distributed to the parents of each child a week prior to the examination to obtain accurate data on birth dates. The examination of dental eruption was carried out under natural light outdoors during the day, using a dental mirror made by Hu Friedy Dental Supply of Chicago. Any stage of dental eruption (e.g. one- third crown erupted or full crown erupted) was scored as erupted. Thus, the term dental eruption refers to the emergence of teeth from the gum into the oral cavity. This was a cross sectional study carried out in April 1999.

TABLE 1.- Sex and age distribution of children in the state elementary school of Imogiri II

Age (years)	Total	Boys	Girls
6 - <7	14	9	5
7 - <8	26	12	14
8 - <9	26	13	13
9 - <10	31	16	15
10 - <11	27	15	12
11 - <12	35	14	21
12 - <13	16	8	8
Total	175	87	88

RESULTS

Results show that at the same age boys show more permanent teeth compared to girls, (Figures. 1 and 2). The mean and median ages of tooth eruption in boys and girls is exhibited in the scatter diagram on Figure 3. The mean ages of tooth eruption are generally earlier than the median ages. The percentage of permanent tooth eruption is higher among boys than among girls (TABLES 2, 3, 4, and 5). These TABLES exhibit the percentage of boys and girls in one-year age intervals, whose permanent teeth had already erupted. The eruption of the third molars was not seen in any of the children in this study. Below is the description of

the one-year age interval in boys and girls in regard to their permanent tooth eruption.

Age 6-7 years

Boys and girls aged 6-7 years do not have permanent canines, first premolars, second premolars, and second molars. In some cases, maxillary central incisors have already erupted (Figs. 1 and 2). The first maxillary and mandibular teeth had already erupted in the majority of boys of age 6-7 years (77.8%), compared to only 60% in girls (TABLES 1 2, 3, 4, dan 5). The lower central incisors have already erupted in 2 out of 3 boys (66.7%) versus only 40% in girls. The upper central incisors have erupted in half of the boys (55.6%), compared to only 20% of the girls (TABLES 2 and 4).

Age 7-8 years

In girls age 7-8 years old, the range of tooth types erupted is larger than in boys (Figs. 1 and 2). While boys this age do not have their permanent canines, first premolars, second premolars, and second molars as well as upper second incisors; girls show eruption in all permanent incisors, and some even display upper first and second premolars eruption. At 7-8 years old, girls do not have permanent canines, lower first and second premolars and second molars.

If we look closely into the percentage of boys and girls in terms of dental eruption, we see that in boys age 7-8 years old, only upper central incisors and first upper molars have erupted (83.3% right, 75% left for upper incisors 91.7% for upper first molars) (TABLE 2). In contrast, girls of 7-8 years old display eruptions of their first and second upper incisors (71.4% right and 57.1% left upper first incisors), a few upper first premolars (7.1% left upper first and second premolars), and upper first molars (92.8% right and 85.7% left) (TABLE 3). Therefore, at the same physiological age of 7-8 years old, fewer tooth types have erupted in boys, compared to girls (see also Figs. 1 and 2). Does this pattern repeat with advancing age? We will see with the following results.

Age 8-9 years

Figures 1 and 2 does not exhibit the pattern of boys showing eruption among fewer tooth types

compared to girls. The number of tooth types and locations in boys is 21 teeth versus 19 teeth in girls. The percentage of boys versus girls aged 8-9 years with their upper permanent tooth eruption is as follow: I¹ (92.3% in boys vs. 100% in girls); I² (30.8% right, 23.1% left in boys vs. 53.8% right, 61.5% left in girls), P¹ (23.1% right, 30.8% left in boys vs. 23.1% right, 15.4% left in girls), M¹ (100% in boys vs. 100% in girls); and rarely C (7.7% right in boys vs. 0 in girls). As shown on TABLES 4 and 5, in lower teeth, I₁ (100% in boys vs. 100% in girls), I₂ (100% in boys vs. 84.6% right, 100% left in girls), and sometimes also C (7.7% in boys vs. 0 right, 7.7% left in girls), P₁ (23.1% in boys vs. 0 right, 7.7% left in girls) and P₂ (7.7% right, 30.8% left in boys vs. 7.7% right, 23.1% left in girls). These numbers suggest that at age 8-9 years old, boys generally show more teeth erupted compared to girls. At age 8-9 years old, the upper and lower second molars have not yet erupted.

Age 9-10 years

The percentage of permanent tooth eruption in boys is higher than in girls at age 9-10 years old. Few children show erupted canines erupted (TABLES 2 to 5). Second molars have also rarely erupted at this age: none in girls, only 6.2% right, 0 left of upper second molars in boys; and 12.5% right vs. 6.25% left of lower second molars in boys.

Age 10-11 years

The percentage of permanent tooth eruption in boys vs. girls of this age is almost the same and has reached 100% in upper incisors and upper first molars.

Age 11-12 years

The percentage of permanent tooth eruption in boys vs. girls of this age is again almost the same and has reached 100% in upper incisors and upper first molars.

Age 12-13 years

At the age of 12 to 13 years, almost all permanent teeth have erupted in boys and girls, although about 25% of children (equal between boys and girls) have not yet had their upper and lower canines erupt.

	RIGHT							LEFT								
6-7 years	-	M ¹	-	-	-	-	I ¹	I ¹	-	-	-	-	-	M ¹	-	MAXILLA
	-	M ₁	-	-	-	-	I ₁	I ₁	I ₂	-	-	-	-	M ₁	-	MANDIBLE
7-8 years	-	M ¹	-	-	-	-	I ¹	I ¹	-	-	-	-	-	M ¹	-	
	-	M ₁	-	-	-	-	I ₁	I ₁	I ₂	-	-	-	-	M ₁	-	
8-9 years	-	M ¹	-	P ¹	-	I ²	I ¹	I ¹	I ²	C	P ¹	-	M ¹	-		
	-	M ₁	P ₂	P ₁	C	I ₂	I ₁	I ₁	I ₂	C	P ₁	P ₂	M ₁	-		
9-10 years	-	M ¹	P ²	P ¹	C	I ²	I ¹	I ¹	I ²	C	P ¹	P ²	M ¹	-		
	M ₂	M ₁	P ₂	P ₁	C	I ₂	I ₁	I ₁	I ₂	C	P ₁	P ₂	M ₁	M ₂		
10-11 years	-	M ¹	P ²	P ¹	C	I ²	I ¹	I ¹	I ²	C	P ¹	P ²	M ¹	-		
	M ₂	M ₁	P ₂	P ₁	C	I ₂	I ₁	I ₁	I ₂	C	P ₁	P ₂	M ₁	M ₂		
11-12 years	M ²	M ¹	P ²	P ¹	C	I ²	I ¹	I ¹	I ²	C	P ¹	P ²	M ¹	M ²		
	M ₂	M ₁	P ₂	P ₁	C	I ₂	I ₁	I ₁	I ₂	C	P ₁	P ₂	M ₁	M ₂		
12-13 years	M ²	M ¹	P ²	P ¹	C	I ²	I ¹	I ¹	I ²	C	P ¹	P ²	M ¹	M ²		
	M ₂	M ₁	P ₂	P ₁	C	I ₂	I ₁	I ₁	I ₂	C	P ₁	P ₂	M ₁	M ₂		

FIGURE 1. Permanent tooth eruption in boys aged 6-13 years of the state elementary school of Imogiri II, Bantul, Yogyakarta.

Note : superscripts represent maxillary teeth, subscripts represent mandibular teeth. I-Incisor, C-canine, P-premolar, M-molar

	RIGHT							LEFT								
6-7 years	-	-	-	-	-	-	-	l ¹	-	-	-	-	-	-	-	MAXILLA
	-	M ₁	-	-	-	l ₂	l ₁	l ₁	l ₂	-	-	-	M ₁	-	MANDIBLE	
7-8 years	-	M ¹	P ²	P ¹	-	l ²	l ¹	l ¹	l ²	-	-	-	M ¹	-		
	-	M ₁	-	-	-	l ₂	l ₁	l ₁	l ₂	-	-	-	M ₁	-		
8-9 years	-	M ¹	P ²	P ¹	-	l ²	l ¹	l ¹	l ²	-	P ¹	-	M ¹	-		
	-	M ₁	P ₂	-	-	l ₂	l ₁	l ₁	l ₂	C	P ₁	P ₂	M ₁	-		
9-10 years	-	M ¹	-	P ¹	-	l ²	l ¹	l ¹	l ²	-	P ¹	P ²	M ¹	-		
	-	M ₁	P ₂	P ₁	C	l ₂	l ₁	l ₁	l ₂	C	P ₁	P ₂	M ₁	M ₂		
10-11 years	M ²	M ¹	P ²	P ¹	C	l ²	l ¹	l ¹	l ²	C	P ¹	P ²	M ¹	M ²		
	M ₂	M ₁	P ₂	P ₁	C	l ₂	l ₁	l ₁	l ₂	C	P ₁	P ₂	M ₁	M ₂		
11-12 years	M ²	M ¹	P ²	P ¹	C	l ²	l ¹	l ¹	l ²	C	P ¹	P ²	M ¹	M ²		
	M ₂	M ₁	P ₂	P ₁	C	l ₂	l ₁	l ₁	l ₂	C	P ₁	P ₂	M ₁	M ₂		
12-13 years	M ²	M ¹	P ²	P ¹	C	l ²	l ¹	l ¹	l ²	C	P ¹	P ²	M ¹	M ²		
	M ₂	M ₁	P ₂	P ₁	C	l ₂	l ₁	l ₁	l ₂	C	P ₁	P ₂	M ₁	M ₂		

FIGURE 2. Permanent tooth eruption in boys aged 6-13 years of the state elementary school of Imogiri II, Bantul, Yogyakarta.

Note : superscripts represent maxillary teeth, subscripts represent mandibular teeth. I-Incisor, C-canine, P-premolar, M-molar

TABLE 2. - Percentage of erupted maxillary teeth in boys in one year age intervals

Maxilla	I1 R	I1 L	I2 R	I2 L	CR	CL	P1 R	P1 L	P2 R	P2 L	M1 R	M1 L	M2 R	M2 L
Age, year														
6-7	55.6	55.6	11.1	11.1	0	0	0	0	0	0	77.8	77.8	0	0
7-8	83.3	75	0	0	0	0	0	0	0	0	91.7	91.7	0	0
8-9	92.3	92.3	30.8	23.1	0	7.7	23.1	30.8	0	0	100	100	0	0
9-10	100	100	93.7	81.2	6.25	12.5	68.7	50	25	31.2	100	100	6.2	0
10-11	100	100	93.3	80	26.7	20	53.3	53.3	24.9	26.7	100	100	6.7	0
11-12	100	100	85.7	100	35.7	28.6	85.7	78.6	57.1	57.1	100	100	42.9	42.9
12-13	100	100	100	100	75	75	100	100	87.5	100	87.5	100	87.5	75

Legend: I1- central incisor, I2-lateral incisor, C-canine, P1-first premolar, P2-second premolar, M1-first molar, M2-second molar, R-right, L-left.

TABLE 3. - Percentage of erupted maxillary teeth in girls in one year age intervals

Maxilla	I1 R	I1 L	I2 R	I2 L	CR	CL	P1 R	P1 L	P2 R	P2 L	M1 R	M1 L	M2 R	M2 L
Age, year														
6-7	0	20	20	0	0	0	0	0	0	0	60	60	0	0
7-8	71.4	57.1	21.4	28.6	0	0	7.1	0	0	7.1	92.8	85.7	0	0
8-9	100	100	53.8	61.5	0	0	23.1	15.4	7.7	0	100	100	0	0
9-10	100	100	86.7	93.3	0	0	46.7	46.7	6.7	0	100	100	0	0
10-11	100	100	100	100	91.47	91.47	75	33.3	41.7	41.7	100	100	16.7	16.7
11-12	100	100	100	100	42.8	47.6	90.5	90.5	76.2	71.4	100	100	19	19
12-13	100	100	100	100	25	25	100	100	100	100	100	100	87.5	87.5

Legend: I1- central incisor, I2-lateral incisor, C-canine, P1-first premolar, P2-second premolar, M1-first molar, M2-second molar, R-right, L-left

TABLE 4. - Percentage of mandibular tooth eruption in boys with one year age intervals

Maxilla	I1 R	I1 L	I2 R	I2 L	CR	CL	P1 R	P1 L	P2 R	P2 L	M1 R	M1 L	M2 R	M2 L
Age, year														
6-7	66.7	66.7	22.2	11.1	0	0	0	0	0	0	77.8	77.8	0	0
7-8	91.7	91.7	50	58.3	0	0	0	0	0	0	91.7	91.7	0	0
8-9	100	100	84.6	84.6	7.7	7.7	23.1	23.1	7.7	30.8	100	100	0	0
9-10	100	100	100	100	18.7	25	37.5	56.2	25	43.7	100	100	12.5	6.25
10-11	100	100	100	100	60	46.7	46.7	33.3	13.3	13.3	100	100	6.7	13.3
11-12	100	100	100	100	57.1	42.8	86.7	57.1	71.4	57.1	100	100	64.3	57.1
12-13	100	100	100	100	87.5	75	100	100	87.5	100	100	100	100	100

Legend: I1- central incisor, I2-lateral incisor, C-canine, P1-first premolar, P2-second premolar, M1-first molar, M2-second molar, R-right, L-left.

TABLE 5. - Percentage of mandibular tooth eruption in girls with one year age intervals

Maxilla	I1 R	I1 L	I2R	I2L	CR	CL	PIR	P1L	P2R	P2L	M1R	M1L	M2R	M2L
Age, year														
6-7	40	40	0	0	0	0	0	0	0	0	60	60	0	0
7-8	92.8	92.8	50	0	0	0	3.6	3.6	0	0	100	100	0	0
8-9	100	100	84.6	100	0	7.7	0	7.7	7.7	23.1	100	100	0	0
9-10	100	100	100	100	6.7	26.7	40	33.3	13.3	13.3	100	100	0	0
10-11	100	100	100	100	25	25	100	100	87.5	100	100	100	100	100
11-12	100	100	100	100	38.1	19	85.7	85.7	71.4	66.7	100	100	61.9	57.1
12-13	100	100	100	100	25	25	100	100	87.5	100	100	100	100	100

Legend: I1- central incisor, I2-lateral incisor, C-canine, P1-first premolar, P2-second premolar, M1-first molar, M2-second molar, R-right, L-left.

The statistical analyses of mean and median ages of permanent tooth eruption are shown on TABLE 6, which implies the order of tooth eruption. In the boys, this order is I₁-M₁, M¹, I¹, I₂, P², P₁, P¹, P₂, P², C₀, M₂, C⁰, M². In girls, the order of tooth eruption is M¹-M₁, I₁, I¹, I₂, P², P₁, P¹, P₂, C⁰, M₂, M². On Figure 3, we see that the mean ages of

tooth eruption is slightly earlier than that of median ages. On upper teeth, dental eruption in boys is generally more advanced than in girls except for upper canines. On lower teeth, dental eruption in boys was only slightly more advanced than in girls, except for lower canines and lower second premolars.

TABLE 6. - Mean and median ages of permanent tooth eruption in Javanese children, and standard deviations of the distribution (years)

	Maxilla							Mandible							
	Boys														
	I1	I2	C	P1	P2	M1	M2	I1	I2	C	P1	P2	M1	M2	
Mean	7.22	8.56	11.58	10.33	10.65	6.73	11.86	Mean	6.66	7.42	11.14	10.49	11.33	6.7	11.22
Median	7.33	8.42	11.5	10.33	10.83	6.83	11.75	Median	6.83	7.5	11.22	10.83	11.46	6.83	11.33
STDEV	0.41	0.64	0.97	1	0.77	0.29	1.08	STDEV	0.33	0.47	1.21	1.05	1.26	0.33	0.62
	Girls														
	I1	I2	C	P1	P2	M1	M2	I1	I2	C	P1	P2	M1	M2	
Mean	7.59	8.82	11.03	10.56	11.05	6.91	11.81	Mean	6.83	7.69	11.08	10.79	11.05	6.82	11.25
Median	7.58	9.04	11	10.92	11.37	6.5	12	Median	6.83	7.67	11	11	11.42	6.75	11.46
STDEV	0.26	0.81	0.52	1.14	0.81	1.25	0.53	STDEV	0.19	0.17	0.69	1.04	0.93	0.17	0.52

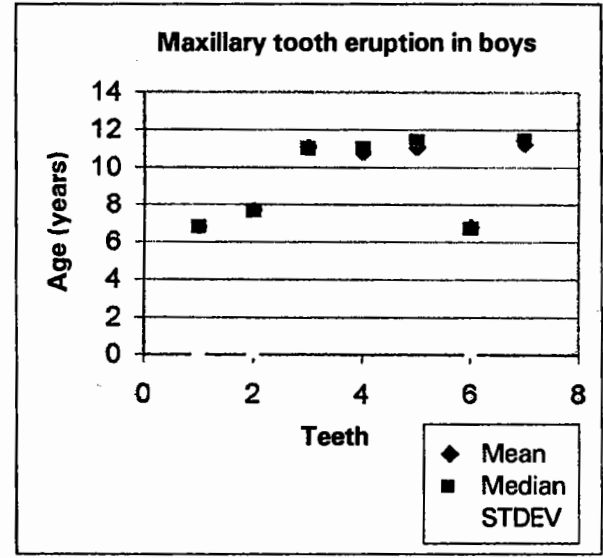
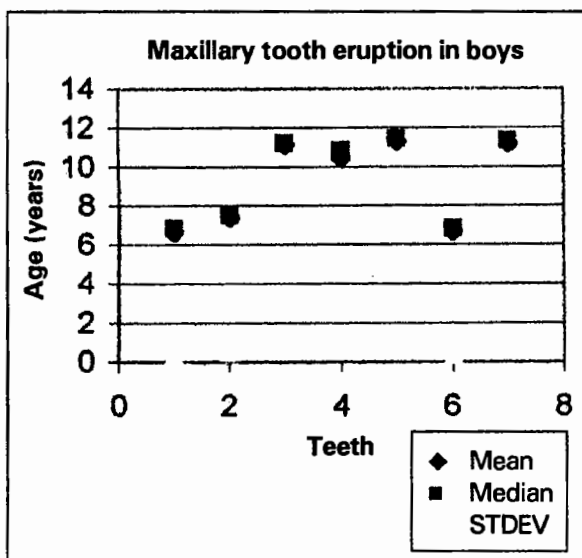
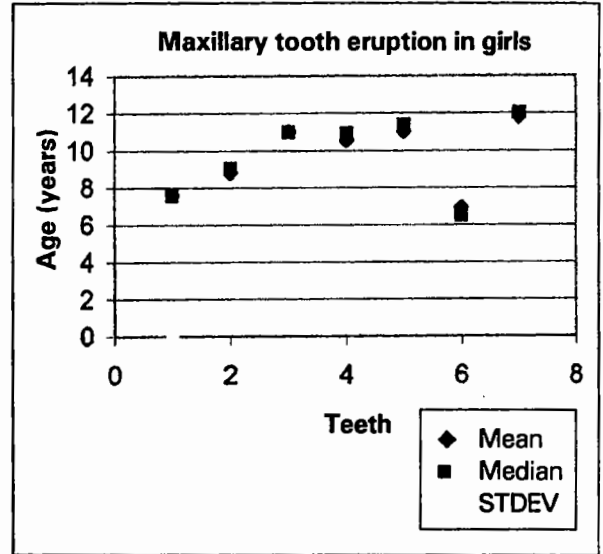
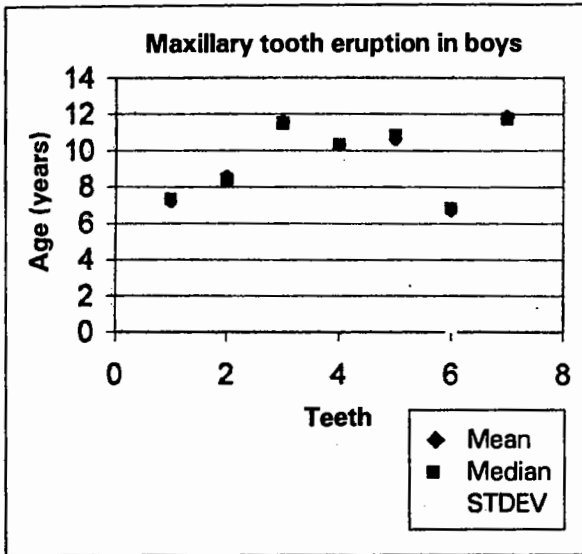


FIGURE 3. Scatter diagrams of permanent tooth eruption in Javanese children from the state elementary school of Imogiri II, Yogyakarta. Numbers in the axis of the diagrams refer to tooth type: 1-central incisor, 2-lateral incisor, 3-canine, 4-first premolar, 5-second premolar, 6-first molar, and 7-second molar

TABLE 7. - Permanent tooth eruption in various human groups

Group	Source	Method	Maxilla						Mandible							
			I1	I2	C	P1	P2	M1	M2	I1	I2	C	P1	P2	M1	M2
Boys																
Java	Indriati, this study	C, mean	7.22	8.56	11.58	10.33	10.65	6.73	11.86	6.66	7.42	11.14	10.49	11.33	6.7	11.22
		C, median	7.33	8.42	11.5	10.33	10.83	6.83	11.75	6.83	7.5	11.22	10.83	11.46	6.83	11.33
Am.Negro	Steggerda & Hills, 1942	L, mean	7.77	8.45	11.74	10.82	11.92	6.79	12.64	6.95	7.94	10.99	10.86	11.48	6.97	12.33
	Suk, 1919	C, median	5.98	6.98	10.17	10.11	10.66	5.26	11.36	5.47	5.96	9.63	10.11	10.75	5.23	11.04
Maya	Steggerda & Hills, 1942	L, mean	8.35	9.3	11.79	10.29	11.63	6.88	12.49	7.41	8.4	11.16	11.14	11.99	6.76	11.86
Navajo	Steggerda & Hills, 1942	L, mean	7.65	8.84	11.07	10.09	10.9	6.68	11.56	6.8	7.72	10.26	10.22	11.18	6.33	11.62
Prima	Dahlberg, 1958	C, median	7.83	8.74	11.66	10.08	11.33	5.98	11.67	6.26	7.65	10.78	10.43	11.39	5.89	11.2
American	Steggerda & Hills, 1942	L, mean	7.87	9.16	11.83	10.72	11.46	7.04	13.05	6.93	8.51	10.94	11.15	11.86	6.98	12.41
American	Hellman, 1943	L, mean	7.33	8.6	12.02	11.17	12.21	6.75	12.96	6.29	7.55	11.04	11.09	12.32	6.82	12.59
American	Fulton & Price, 1954	L, mean	7.26	8.42	11.38	10.42	11.12	6.63	12.09	6.54	7.54	10.75	11.09	11.8	6.32	11.83
American	Cattell, 1928	C, median	7.33	8.42	11.5	10.33	11.08	6.33	12.16	6.25	7.58	10.66	10.58	11.33	6.16	11.66
American	Cohen, 1928	C, median	7.1	8.6	11.5	10.2	10.7	6.4	12.8	6.4	7.5	10.3	10.8	11.4	6.4	11.8
American	Klein <i>et al.</i> , 1938	C, median	7.49	8.62	11.8	10.42	11.18	6.64	12.7	6.5	7.64	10.7	10.75	11.45	6.44	12.2
English	Stones <i>et al.</i> , 1951	L, mean	8.1	8.85	12.24	10.93	11.38	6.72	12.43	6.85	8.12	11.41	11.4	12.12	6.91	12.16
English	Ainsworth, 1925	C, median	7.42	8.81	11.73	9.96	10.89	6.34	12.33	6.49	7.72	10.8	10.86	11.8	6.24	11.86
English	Clements <i>et al.</i> , 1953	C, median	7.01	8.18	11.46	10.41	11.52	6.11	11.97	6.08	7.3	10.51	11.35	12.32	6.14	11.41
New Zealand	Leslie, 1951	C, median	7.26	8.32	11.4	11.01	11.74	6.47	12.47	6.38	7.42	10.78	11.34	12.18	6.46	11.89

TABLE 7. - Permanent tooth eruption in various human groups

Group	Source	Method	Maxilla						Mandible							
			I1	I2	C	P1	P2	M1	M2	I1	I2	C	P1	P2	M1	M2
Girls																
Java	Indriati, this study	C, mean	7.59	8.82	11.03	10.56	11.05	6.91	11.81	6.83	7.69	11.08	10.79	11.05	6.82	11.25
		C, median	7.58	9.04	11	10.92	11.37	6.5	12	6.83	7.67	11	11	11.42	6.75	11.46
Am.Negro	Steggerda & Hills, 1942	L, mean	7.13	8.31	10.39	10.07	10.97	6.9	11.85	6.28	7.19	9.73	10.23	10.77	6.33	11.43
Zulu	Suk, 1919	C, median	6.18	7.14	9.72	9.76	10.06	5.77	10.92	5.85	6.23	9.12	9.76	10.24	5.49	10.61
Maya	Steggerda & Hills, 1942	L, mean	8.27	8.63	10.89	9.96	10.92	6.69	12.09	7.15	8.09	10.32	10.24	11.16	6.68	11.49
Navajo	Steggerda & Hills, 1942	L, mean	7.71	8.66	10.68	9.88	11.38	6.61	11.43	6.48	7.44	9.81	10.18	10.47	6.43	11.23
Pima	Dahlberg, 1958	C, median	7.47	8.34	10.94	9.63	10.73	5.8	11.38	6.15	7.32	9.66	9.87	10.73	5.43	10.8
American	Steggerda & Hills, 1942	L, mean	7.59	8.78	11.41	10.52	11.33	6.97	12.62	6.58	8	10.22	10.63	11.52	6.59	11.86
American	Hellman, 1943	L, mean	7.24	8.17	11.74	10.83	11.94	6.89	12.93	6.26	7.43	10.26	10.66	11.74	6.7	12.61
American	Fulton & Price, 1954	L, mean	7	7.87	10.55	9.91	10.46	6.32	11.59	6.21	6.92	9.66	10.08	10.79	6.04	10.91
American	Cattell, 1928	C, median	7.08	8	11.08	9.92	10.92	6.16	12.08	6.08	7.25	9.66	10.08	11.08	6	11.42
American	Cohen, 1928	C, median	6.9	7.9	10.7	9.9	10.7	6.1	12.2	6.1	7	9.6	10.1	10.8	5.9	11.6
American	Klein <i>et al.</i> , 1938	C, median	7.2	8.15	11.05	10	10.82	6.54	12.4	6.19	7.31	9.85	10.2	11	6.12	11.9
English	Stones <i>et al.</i> , 1951	L, mean	7.67	8.66	12.01	10.47	11.11	6.6	12.11	6.81	8.05	10.67	11.43	12.01	6.57	12.21
English	Alnsworth, 1925	C, median	7.2	8.37	11.2	9.77	10.72	6.12	12.07	6.23	7.5	9.9	10.36	11.21	5.95	11.52
English	Clements <i>et al.</i> , 1953	C, median	6.62	7.82	10.67	9.79	11.06	5.94	11.5	5.77	7.01	9.41	10.53	11.64	5.84	11.18
New Zealand	Leslie, 1951	C, median	6.83	7.86	10.82	10.52	11.24	6.38	12.2	6.19	7.16	9.74	10.54	11.73	6.3	11.36

Legend: C: cross section, L-longitudinal. Table is adapted and modified from Dahlberg and Menegaz-Bock, 1958.

DISCUSSION

Compared to other human groups, permanent tooth eruption in Javanese children starts 1-10 months later but finishes around the same time, as shown on TABLE 7. These other human groups include English, American, Pima Indians, Navajo Indians, Maya of central America, Black Americans, and New Zealanders. The mean ages often show earlier ages of eruption than median ages, although the difference is very small (about 2 months). This is consistent with the reports of Dahlberg and Menegaz-Bock (1958)²¹. Regardless of sex, posterior teeth erupt earlier than anterior teeth. The first molars erupt earlier than incisors in girls, which is consistent with the finding of Dahlberg and Menegaz-Bock²¹ in Pima Indians. However, in Javanese boys, the first molars erupt about the same time as with the incisors. The eruption of the remaining permanent teeth is within the range of other human groups. Javanese children's tooth eruption is within the range of the summary given by Schour and Massler^{32 and 33}, later compiled by Ubelaker³, and both were redrawn in Hillson³⁴ as Figures 5.8 and 5.9.

Before a tooth erupts, its formation has already taken place over many years. The formation of teeth grew vertically from the crown toward the apical root (Moorrees *et al.*, 1963b)². For instance, molar tooth development commences with initial cusp formation, coalescence of cusps, cusp outline completion, crown half-complete, crown three-quarters complete, crown complete, initial root formation, and initial cleft formation. This crown formation is followed by root formation: one-quarter root length, half-root length, three-quarter root length, root length incomplete, apex half closed, and apical closure completed. Based on the sequence of the tooth formation, the tooth could erupt, piercing the gum when the apical closure of its root is not yet complete, as often seen in radiographs. Nolla's study¹⁶ on dental development concludes that the type of growth displayed by each tooth is the same. There is no systematic study on the relationship

between dental development completeness and the time of dental eruption. However, Nolla's study¹⁶ found that the rates of development in both sexes does not differ significantly, nor does the general sequence of development. The study of dental eruption in Javanese children shows a slightly different sequence of dental eruption between boys and girls with first molars erupting earlier than central incisors in girls with the opposite holding true for the boys.

CONCLUSION

1. In Javanese children, a different order of tooth eruption occurs between boys and girls.
2. Javanese boys are more advanced in their permanent tooth eruption than girls
3. Javanese children's permanent teeth begin erupting later but finish erupting at about the same time, compared to English, American, Maya, Black American, Zulu, Maya, Navajo Indian and Pima Indian.
4. Dental eruption in Javanese children began at the median age of 6.70 years and finishes at the median age of 11.86 years.
5. Despite presenting only one aspect of growth study, this study should be a helpful reference on age determination in forensic cases among subadult individuals when only skeletons and teeth have been preserved.
6. More studies on tooth eruption in other Indonesian populations would be useful to find whether there are variations in tooth eruption's schedule.

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