



Comparison of Time and Sequence of Permanent Tooth Eruptions in Chinese and Arabic Ethnic Groups

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Abstract

Introduction. Tooth eruption is a process of moving teeth into the oral cavity through the soft tissue and mucosa that lines the jaw until it comes into contact with the antagonistic teeth and functions in mastication. The timing and sequence of tooth eruptions for each individual varies, which is influenced by several factors, one of which is race and ethnicity. Indonesia is known as a multi-ethnic country, including Chinese and Arabic ethnic groups. The purpose of the study was to compare the timing and sequence of eruption of permanent teeth in ethnic Chinese and Arabs.

Methods. This type of research is an observational study with a cross-sectional design. The sample of this study was 327 children consisting of 201 Chinese and 126 Arab ethnicities with an age range of 6-13 years. The eruption of all permanent teeth was examined except for the third molar. The mean time to eruption of permanent teeth was calculated using the Karber method. The data were analyzed statistically using the Mann-Whitney test.

Results. The first permanent teeth erupted in the two ethnic groups were the mandibular central incisors around the age of 7 years and the last eruption was the maxillary second molar around the age of 11 years. Significant differences in the eruption time of the permanent teeth between ethnicities were shown in the maxillary central and second molars and lateral incisors and mandibular first molars ($p < 0.05$). The eruption sequence pattern in both ethnicities was almost the same except for the canines and second premolars in the upper and lower jaws.

Conclusion. There are differences in the timing and sequence of eruption of permanent teeth between ethnic Chinese and Arabs.

Keywords. ethnic Chinese, Arab ethnicity, permanent teeth, eruption time, sequence

Introduction

Tooth eruption is a process of moving the teeth into the oral cavity through the soft tissue and mucosa that lines the jaw to make contact with the antagonistic tooth and functions in mastication.¹ Tooth eruption is clinically assessed when part of the crown of the tooth appears on the surface of the gingiva.² Permanent teeth are teeth that will not be replaced by other teeth throughout life.^{2,3} The timing of tooth eruption can be used as an indicator of the maturity of the developmental stage, assist in the diagnosis and planning of dental treatment, and help estimate the age of the victim in forensic dentistry.⁴ The sequence of tooth eruptions can be used to estimate a race or ethnicity in the field of medical forensics.⁵ The timing and sequence of tooth eruptions



for each individual is different, because it can be influenced by several factors, one of which is race and ethnicity.^{6,7}

Indonesia is known as a multi-racial and multi-ethnic country. The Indonesian population consists of several main races, namely the Mongoloid and Australomelanesid races.⁸ There are other races who came and settled to live in Indonesia, such as the Caucasoid race. Each racial group has its own distinct characteristics.⁸ The characteristics of each race can also be distinguished by the craniofacial bones and teeth.^{9,10,11} Based on the physical characteristics of the ethnicity, the Chinese were considered quite representative to represent the Mongoloid race, while the Arab ethnicity could represent the Caucasoid race. Ethnic Chinese and Arabic are major ethnic groups in Indonesia. These ethnic groups have long lived in Indonesia, including the city of Palembang.¹² The majority of the two ethnic groups still adhere to the tradition of marrying each other to maintain their respective racial characteristics.

Racial differences can also influence tooth eruption.¹³ Khan's investigation of a Pakistani population representing the Caucasoid race showed that the mandibular canines erupted earlier than the maxillary first premolar.⁵ Etty researched on the Javanese population representing the Mongoloid race and showed that the maxillary first premolar erupted earlier than the mandibular canine.¹⁴ The same finding was also reported in a population in Uganda representing the Negroid race.¹⁵ This study aimed to compare the timing and sequence of eruption of permanent teeth among ethnic Chinese and Arabs.

Methods

This study has conducted an *ethical clearance* by the Ethical Commission of the Mohammad Hoesin Central General Hospital and the Faculty of Medicine, Sriwijaya University with the ethical approval certificate number 158 / kepkrsmhfkunsri / 2016. In this *cross sectional* study, the research subjects were 327 children who were taken by *purposive sampling* technique. Two schools were included in this study. Indriasana Primary School represents Chinese ethnicity, and MI Adabiyah II Palembang represents Arab ethnicity. The inclusion criteria for the subjects in this study were children of Chinese / Arabic ethnicity aged 6-13 years. The exclusion criteria in this



study were children who used orthodontic appliances, had hereditary disorders, systemic diseases, and local conditions that affected tooth eruption.

The objectives and research methods were explained to all subjects and their parents. Informed consent signed by each parent was obtained from all subjects involved. The date of birth information was obtained from the subject's parents to calculate chronological age. Examination of the erupted teeth was carried out by three examiners, who had previously been calibrated. Calibration was carried out with a sample of 20 children from Methodist 1 Palembang Elementary School (ethnic Chinese) and MI Adabiyah II Palembang (ethnic Arabic). The results were tested for inter-reliability with a kappa value of 0.93 which categorized as very good. Examination was carried out during the day using a glass mouth and a sonde, and with the aid of a flashlight. The tooth is declared to be erupted when it has penetrated the gingiva. Teeth that have been extracted are considered erupted, while agenesis are considered unerupted.

The mean and standard deviation of eruption times of permanent teeth were calculated based on the Karber method in units of years. The mean eruption time of permanent teeth was sorted based on the fastest tooth eruption time to determine the eruption sequence of each tooth in Chinese and Arabic ethnic groups which were presented in tabular form. Data were analyzed using SPSS version 24 software with the Mann-Whitney test to compare the eruption time of each tooth for Chinese and Arab ethnic groups with a significance value of less than 0.05 ($p < 0.05$).

Results

In this study, the number of Chinese ethnic subjects were more than Arabic. The frequency distribution of age and ethnicity is shown in Table 1.

Table 1. Frequency distribution of age and ethnicity (n = 327)

Age (years)	Ethnic Chinese	Arab Ethnicity	Total
6	28	21	49
7	25	22	47
8	40	15	55
9	59	27	86
10	39	28	67
11	10	13	23
Total	201	126	327



Table 1 shows that the most number of study subjects was at the age of 9 years and at least at the age of 11 years, with the age distribution of the subjects being more evenly distributed among ethnic Chinese than Arab ethnicities. Comparison of eruption times between ethnicities is shown in Table 2.

Table 2. Comparison of eruption times between ethnicities (years)

	Ethnic Chinese		Arabic Ethnicity		Nilai p	
	Mean ± SD	Median ± SD	Mean ± SD	Median ± SD		
Upper Jaw						
I ₁	7,88 ± 2,30	7,56 ± 0,12	8,06 ± 1,96	7,83 ± 0,10	0,02	*
I ₂	8,72 ± 2,15	8,46 ± 0,11	8,61 ± 1,58	8,47 ± 0,08	0,20	
C	10,80 ± 1,34	10,72 ± 0,05	10,76 ± 1,35	10,67 ± 0,05	0,51	
P ₁	9,34 ± 1,91	9,15 ± 0,09	9,79 ± 1,66	9,66 ± 0,07	0,14	
P ₂	10,78 ± 1,31	10,70 ± 0,05	10,95 ± 1,06	10,90 ± 0,04	0,93	
M ₁	7,66 ± 2,30	7,33 ± 0,13	7,77 ± 2,01	7,52 ± 0,11	0,07	
M ₂	11,76 ± 0,64	11,75 ± 0,02	11,26 ± 0,76	11,24 ± 0,03	0,00	*
Lower Jaw						
I ₁	7,27 ± 2,43	6,90 ± 0,14	7,61 ± 2,01	7,36 ± 0,11	0,33	
I ₂	7,91 ± 2,27	7,60 ± 0,12	8,31 ± 1,74	8,14 ± 0,09	0,02	*
C	10,24 ± 1,69	10,10 ± 0,07	10,44 ± 1,34	10,35 ± 0,06	0,07	
P ₁	9,99 ± 1,66	9,86 ± 0,07	10,06 ± 1,20	9,99 ± 0,05	0,34	
P ₂	10,71 ± 1,46	10,62 ± 0,06	10,40 ± 1,24	10,33 ± 0,05	0,23	
M ₁	7,35 ± 2,46	6,97 ± 0,14	7,92 ± 2,02	7,66 ± 0,11	0,00	*
M ₂	11,51 ± 0,90	11,48 ± 0,03	11,08 ± 0,75	11,05 ± 0,03	0,07	

Mann-Whitney test, * significantly different (p <0.05)

Table 2 shows that the first tooth erupted in ethnic Chinese and Arabs was a single mandibular incisor with a mean eruption time of 7.27 and 7.61 years, respectively, while the last erupted teeth in both Chinese and Arab ethnic groups were maxillary second molars with mean eruption times of 11.76 and 11.26 years, respectively. The eruption time of the permanent teeth of the Chinese ethnic group was faster than the Arabs, except for the second incisor, canine, maxillary second molar and mandibular second molar. Based on the table, it can be observed that the eruption time of the permanent teeth of the Chinese ethnic group is significantly faster than that of the Arabs



in the maxillary one incisor and two incisors, the mandibular first molar. The eruption time of the Arab permanent teeth was significantly shorter than that of the Chinese on the maxillary second molar. The sequence of eruption of permanent teeth in ethnic Chinese and Arabs is shown in Table 3.

Table 3. Eruption sequence of permanent teeth

No	Ethnic Chinese		Arabic Ethnicity	
1	I ₁	RB	I ₁	RB
2	M ₁	RB	M ₁	RA
3	M ₁	RA	M ₁	RB
4	I ₁	RA	I ₁	RA
5	I ₂	RB	I ₂	RB
6	I ₂	RA	I ₂	RA
7	P ₁	RA	P ₁	RA
8	P ₁	RB	P ₁	RB
9	C	RB	P ₂	RB
10	P ₂	RB	C	RB
11	P ₂	RA	C	RA
12	C	RA	P ₂	RA
13	M ₂	RB	M ₂	RB
14	M ₂	RA	M ₂	RA

Table 3 shows that the eruption sequence pattern in the two ethnicities was almost the same except for the canines and second premolars in the upper and lower jaws. The maxillary double premolar erupted faster than the maxillary canine in ethnic Chinese, on the other hand, the maxillary canine erupted faster than the maxillary second premolar in Arab ethnicity.

Discussions

The results showed that the eruption time of permanent teeth between ethnic Chinese and Arabs did not differ much from the literature. The difference was less than 1 year. This is in line with Indriyati's research, which reported that variations in the timing of tooth eruption are still considered normal if the difference is around 2 years.²⁰ In all samples, the eruption time of the



mandibular permanent teeth was faster than that of the maxilla except for the first premolar. This is in line with the research of Ritva and Inderjeet et al.^{21,22} Farokhgissor et al also reported that the eruption time of permanent teeth was faster in the mandible than in the upper jaw.²³ This is because the mandible is actively moving, which triggers the growth and development of bones and teeth.²⁴

Broadly speaking, this study shows that the eruption time of Chinese permanent teeth is faster than that of Arabs. This can be caused by a factor in the size of the jaw arch. The size of the arch of the jaw of the ethnic Chinese is wider than that of the Arab, so that the teeth have sufficient space for eruption.¹⁵ The narrow space causes crowding of teeth, which is often found in Arab ethnicities.^{15,25,26} The narrow eruption space can inhibit tooth eruption, so that the eruption time of permanent teeth of Arab ethnicity is longer than that of ethnic Chinese.

This study showed that the eruption of maxillary second molars was significantly faster in Arab ethnic than Chinese, due to differences in sexual maturation between races. This is in line with studies which reported that the sexual maturation rate of the Caucasoid race is faster than that of the Mongoloid.²⁷ Sexual maturation is associated with pubertal growth spurt, so that jaw growth is faster in the Caucasoid race.^{27,28} The onset of the pubertal growth spurt and the eruption of permanent second molars is around the age of 12 years.

The variation in the sequence of eruption of permanent teeth between ethnic Chinese and Arabs lies in the canines and second premolars. This is in line with a number of studies that show that the eruption time of the two teeth often varies.^{16,22,14} Variations in the timing of tooth eruption can be influenced by a number of factors, including genetics, socioeconomic status, and nutrition.^{16,21,23,29} Genetic factors have a big role in determining the eruption time of permanent teeth. Genetics influence the phenotype of tooth eruption such as in the secretion of parathyroid hormone-related protein (PTHrP).^{6,30} PTHrP is a formation regulatory molecule required for tooth eruption. Each individual has different DNA, even in monozygous twins.⁶ This shows that each individual has a high variation in tooth eruption.^{6,30} Socio-economic status is one of the factors that influence tooth eruption. It is reported that the eruption time in the middle socioeconomic status group is faster than the lower.¹⁶ Socio-economic status can also affect nutrition, because populations with low socioeconomic levels are more likely to experience malnutrition. Low nutrition can slow down the eruption time of the teeth.^{16,29} The nutrients that influence tooth



eruption include protein.³¹ In this study, these factors are uncontrolled, in further research it needs to be controlled to get more accurate results.

In this study, a total sample of 327 children consisting of 201 Chinese and 126 Arab ethnicities had an unequal age distribution. This will affect the mean time and standard deviation of eruption of permanent teeth obtained from the Karber method. Therefore, in further research, more samples and a more even distribution of sample ages are needed.

The results showed that there were variations in the timing and sequence of eruption of permanent teeth in Chinese and Arabic ethnic groups. Information on variations in timing and sequence of eruption of permanent teeth can be useful in the fields of forensics, pedodontics, and orthodontics. Information on the timing and eruption sequence of permanent teeth can help forensic dentistry as well as identify the age of the victim based on the eruption sequence.⁵ In addition, this information can help pedodontics and orthodontists in planning dental treatment.

Conclusion

There are differences in the timing and sequence of eruption of permanent teeth between ethnic Chinese and Arabs.

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