Third Molar Development Age Range on Indonesian Population from Various Ethnics Based on Radiograph Findings: A Preliminary Study

*Muhammad Luthfi[1], Winoto Suhartono[1], Annisa Dwi Puspita[1], Elza Ibrahim Auerkari[1]**

1. Department of Oral Biology, Faculty of Dentistry, University of Indonesia, Jakarta-Indonesia.

Abstract

Disaster victims often require identification based on methods that work with limited remaining material, and one such supporting method is based on using the third molar as the reference for age assessment of the victim.

This study aimed to determine the age range of third molar development stages of the Indonesian population.

The descriptive study utilized orthopantomograms and the tooth development stages by Demirjian as the study instrument.

The results showed that the average Indonesian population reaches the dental maturity stage at the mean age 22.5 ±3.0 years for males and 23.5 ±3.6 years for females.

There is also sexual dimorphism in the rate of third molar development, where the development in males accelerating after the age of around 14 years. Tooth development on lower jaw is observable of lower rate compared with the upper jaw.

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Introduction

Indonesia as an archipelago between two oceans, two continents, and two major tectonic plates is relatively prone to disasters.

The victims of disaster victims are often found without identity, or are unidentifiable by the disaster relief team. To help in such situations supporting methods of identification have been developed, one of which is age determination through assessed stages of third molar development.

Aside from disaster relief and identification of disaster victims, the method can also be used in other legal challenges involving subject age and identity, for example to provide supporting evidence in cases of juvenile crime, child custody, and inheritance.

Corresponding author:
Elza Ibrahim Auerkari
Department of Oral Biology, Faculty of Dentistry, University of Indonesia.
Salemba Raya 4; Jakarta 10430; Indonesia
E-mail: eauerkari@yahoo.com

Most early studies on age determination through assessment of third molar development have been conducted using homogeneous samples of Caucasian origin. Subsequent studies have shown the necessity to develop auxiliary population-specific databases to achieve the best accuracy in determining dental age.[1,2] As Indonesian population is composed of a various subgroups of ethnic origin, a local database is necessary to avoid misidentification.[3]

This preliminary study aimed to determine the age range of third molar development stage in the Indonesian population.

Materials and methods

In this descriptive study, orthopantomograms of 100 subjects at a known chronological age between 13 and 29 years (30 males and 70 females) were assembled from patient files of the Dental Hospital of the Faculty of Dentistry, University of Indonesia.

Table 1 shows the numbers of orthopantomograms included in this study according to age and gender category. As each

third molar on every region of jaws are present in all of the evaluated orthopantomograms, this study was based on the developmental stages of 400 third molars.

The categorization of jaw regions was based on the standards published by FDI. The following terms are used to address each region: Regio 1 for Upper Right, Regio 2 for Upper Left, Regio 3 for Lower Left, and Regio 4 for Lower Right.

	Males	Females	Total (*n*)
13 Years	3	4	7
14 Years	3	5	8
15 Years	4	4	8
16 Years	2	7	9
17 Years	2	5	7
18 Years	1	6	7
19 Years	3	4	7
20 Years	2	4	6
21 Years	1	5	6
22 Years	4	3	7
23 Years	1	6	7
24 Years	-	4	4
25 Years	1	3	4
26 Years	2	2	4
27 Years	1	1	2
28 Years	-	3	3
29 Years	-	4	4
Absolute (*n*)	30	70	100

Table 1. Numbers of orthopantomograms in the age and gender categories

Tables 2A and 2B show the distribution of tooth development stages according to age and gender category.

The subject inclusion criteria of the orthopantomograms in the study were: Indonesian of Mongoloid origin, no medical history, no obvious dental pathology on the panoramic radiograph related to the third molars, age between 13 and 29 years at the time the orthopantomogram was taken.

The dental age classification was performed using the modified Demirjian classification.[4, 5]

The development of third molars was divided into eight stages as follows:

Stage A

In both un radicular and multiradicular teeth, a beginning of calcification is seen at the superior level of the crypt in the form of an inverted cone or cone. There is no fusion of these calcified points.

Stage B

Fusion of the calcified points forms one or several cusps which unite to give a regular outlined occlusal surface.

Stage C

a. Enamel formation is complete at the occlusal surface. Its extension and convergence towards the cervical region are seen.
b. The beginning of dentinal deposit is seen.
c. The outline of the pulp chamber has a curved shape at the occlusal border.

Stage D

a. The crown formation is completed down to the cementoenamel junction.
b. The superior border of the pulp chamber in the uni radicular teeth has a curved form, being concave towards the cervical region. The projection of the pulp horns if present, gives an outline shaped like an umbrella top. In molars, the pulp chamber has a trapezoidal form.

Stage E

Uniradicular teeth:
a. The walls of the pulp chamber now form straight lines, whose continuity is broken by the presence of the pulp horn, which is larger than in the previous stage.
b. The root length is less than the crown height.

Molars:
a. Initial formation of the radicular bifurcation is seen in the form of either a calcified point or a semi-lunar shape.
b. The root length is still less than the crown height.

Stage F

Uniradicular teeth:
a. The walls of the pulp chamber now form a more or less isosceles triangle. The apex ends in a funnel shape.
b. The root length is equal to or greater than the crown height.

Molars:
a. The calcified region of the bifurcation has developed further down from its semi-lunar stage to give the roots a more definite and distinct outline with a funnel shaped endings.
b. The root length is equal to or greater than the crown height.

Stage G

The walls of the root canal are now parallel, and its apical end is partially open (Distal root on molars)

Stage H

a. The apical end of the root canal is completely closed. (Distal root on molars).
b. The periodontal membrane has a uniform width around the root and the apex.

Results

From the results, it is seen that upper jaw tends to grow at a higher rate of development than lower jaw. This can be seen for both genders as presented in Table 3.

From Table 3, it can be seen that the male subjects reached the maturity of third molars by the age of 22,5 ± 3 years for the lower jaw and 22,64 ± 3,5 years for the upper jaw. The female subjects reached the maturity of third molars by the age of 24 ± 3,6 years for the lower jaw, and 23,1 ± 3,9 years for the upper jaw.

Development stage		Regio_1					Total	Regio_2					Total	Regio_3					Total	Regio_4					Total
		D	E	F	G	H		D	E	F	G	H		D	E	F	G	H		D	E	F	G	H	
Age	13	3	-	-	-	-	3	3	-	-	-	-	3	3	-	-	-	-	3	3	-	-	-	-	3
	14	3	-	-	-	-	3	3	-	-	-	-	3	3	-	-	-	-	3	3	-	-	-	-	3
	15	1	-	1	1	1	4	1	-	2	1	-	4	2	-	2	-	-	4	2	-	2	-	-	4
	16	-	1	1	-	-	2	-	1	1	-	-	2	-	1	1	-	-	2	-	1	1	-	-	2
	17	1	-	1	-	-	2	1	-	1	-	-	2	1	1	-	-	-	2	1	1	-	-	-	2
	18	-	-	-	-	1	1	-	-	-	-	1	1	-	-	-	-	1	1	-	-	-	-	1	1
	19	1	-	-	-	2	3	-	-	1	-	2	3	1	-	-	-	2	3	-	1	-	-	2	3
	20	-	-	2	-	-	2	-	-	1	1	-	2	-	-	-	2	-	2	-	-	1	1	-	2
	21	-	-	-	1	-	1	-	-	-	1	-	1	-	-	-	-	1	1	-	-	-	-	1	1
	22	-	-	-	-	4	4	-	-	-	1	3	4	-	-	-	1	3	4	-	-	-	1	3	4
	23	-	-	-	-	1	1	-	-	-	-	1	1	-	-	-	-	1	1	-	-	-	-	1	1
	25	-	-	-	-	1	1	-	-	-	-	1	1	-	-	-	-	1	1	-	-	-	-	1	1
	26	-	-	-	-	2	2	-	-	-	-	2	2	-	-	-	-	2	2	-	-	-	-	2	2
	27	-	-	-	-	1	1	-	-	-	-	1	1	-	-	-	-	1	1	-	-	-	-	1	1
Total		9	1	5	2	13	30	8	1	6	4	11	30	10	2	3	3	12	30	9	3	4	2	12	30

Table 2 A. Tooth development distribution on each region for males; the numbers in the table represent occurred cases.

Development stage		Regio_1						Total	Regio_2						Total	Regio_3						Total	Regio_4						Total
		C	D	E	F	G	H		C	D	E	F	G	H		C	D	E	F	G	H		C	D	E	F	G	H	
Age	13	-	3	1	-	-	-	4	-	3	1	-	-	-	4	-	4	-	-	-	-	4	-	4	-	-	-	-	4
	14	-	3	1	1	-	-	5	-	3	1	1	-	-	5	1	1	3	-	-	-	5	1	2	1	1	-	-	5
	15	1	1	-	1	1	-	4	1	-	1	2	-	-	4	-	1	1	2	-	-	4	1	1	-	2	-	-	4
	16	1	2	-	2	-	2	7	-	2	3	-	-	2	7	-	3	1	2	-	1	7	-	3	-	3	-	1	7
	17	-	1	-	2	2	-	5	-	1	-	2	2	-	5	-	-	1	2	2	-	5	-	1	-	2	2	-	5
	18	-	-	-	-	2	4	6	-	-	-	-	2	4	6	-	-	-	3	3	-	6	-	-	-	3	2	1	6
	19	-	-	1	2	-	1	4	-	1	1	1	-	1	4	-	-	1	1	1	1	4	-	1	1	-	1	1	4
	20	-	-	-	-	1	3	4	-	-	-	-	2	2	4	-	-	-	1	1	2	4	-	-	-	1	1	2	4
	21	-	-	-	1	3	1	5	-	-	-	1	3	1	5	-	-	-	1	3	1	5	-	-	-	2	2	1	5
	22	-	-	-	-	-	3	3	-	-	-	-	-	3	3	-	-	-	-	-	3	3	-	-	-	-	-	3	3
	23	-	-	-	2	1	3	6	-	-	-	1	2	3	6	-	-	-	1	3	2	6	-	-	-	1	1	4	6
	24	-	-	-	1	-	3	4	-	-	-	1	-	3	4	-	-	-	1	-	3	4	-	-	-	1	-	3	4
	25	-	-	-	-	-	3	3	-	-	-	-	-	3	3	-	-	-	-	-	3	3	-	-	-	-	-	3	3
	26	-	-	-	-	-	2	2	-	-	-	-	-	2	2	-	-	-	-	1	1	2	-	-	-	-	1	1	2
	27	-	-	-	-	-	1	1	-	-	-	-	-	1	1	-	-	-	-	-	1	1	-	-	-	-	-	1	1
	28	-	-	-	-	-	3	3	-	-	-	-	-	3	3	-	-	-	-	-	3	3	-	-	-	-	-	3	3
	29	-	1	-	-	-	3	4	-	-	-	-	1	3	4	-	-	-	-	-	4	4	-	-	-	-	-	4	4
Total		2	11	3	12	10	32	70	1	10	7	9	12	31	70	1	9	7	14	14	25	70	2	12	2	16	10	28	70

Table 2 B. Tooth development distribution on each region for females; the numbers in the table represent occurred cases.

		Stage C		Stage D		Stage E		Stage F		Stage G		Stage H	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Male	Regio 1	-	-	14,67	2,06	16,00		17,60	2,30	18,00	4,24	22,00	3,54
	Regio 2	-	-	14,13	1,36	16,00		17,00	2,10	19,50	3,11	22,64	3,11
	Regio 3	-	-	14,70	1,95	16,50	0,71	15,33	0,58	20,67	1,15	22,50	3,00
	Regio 4	-	-	14,22	1,30	17,33	1,53	16,50	2,38	21,00	1,41	22,50	3,00
Female	Regio 1	15,50	0,71	15,82	4,58	15,33	3,21	18,67	3,39	19,10	2,47	23,00	3,93
	Regio 2	15,00		14,90	2,02	15,57	1,90	18,33	3,64	20,67	3,34	23,10	3,96
	Regio 3	14,00		14,33	1,41	15,57	1,90	18,36	2,79	20,36	2,71	24,32	3,57
	Regio 4	14,50	0,71	14,92	1,93	16,50	3,54	18,06	2,95	20,00	2,87	24,00	3,58

Table 3. Mean age of third molar development stages (Years).

Discussion

The results show that both genders of the sampled Indonesian population had reached the stage D of third molar development at the same age range of 14 ± 2 years. In the next stage (Stage E) growth acceleration was present in females. The stage E in males appeared at the age of 16,1±1,7 years and in females at the age range of 15,6±1,1 years. Starting from stage F, the male subjects presented growth acceleration from females. The stage F was attained in males at the age of 17,0±2,1 years and in females at the age of 18,3±3,6 years, and stage G in males at the age of 18,3±3,6 years and in females at the age of 20,7±3,3 years. The stage H was presented on males at the age of 22,6±3,1 years and in females at the age of 24,3±3,6 years.

A previous study on a population in US showed maturity of the third molar growth at the age of 20 years.[6]

Another study showed that Swiss and South East European populations reached maturity of the third molar growth at the age of 20 years.[7] A separate study on Spanish population showed the third molar growth maturity at the mean age of 19,74 years in males and 20,1 years in females.[8] In Asian populations dominated by Mongoloid origin, it is conventionally expected a longer period to complete the dental development than in Caucasian-dominated American and European populations.[9,10]

Some studies have presented nearly the same results as those of the present study. A study on the Japanese population indicated third molar growth maturity at the age of 22,5±1,8 years in males and 22,1±1,8 years in females.[9] Another study on German and South African populations also presented age ranges of third molar growth maturity that were close to those for the Indonesian population. On German population, the mean age to reach the third molar growth maturity was 22,5±1,7 years for males and 22,9±1,7 years for females. Similar results were observed from a South African population where males reached the third molar growth maturity at the age of 22,6±1,9 years and females at the age of 22,4±1,9 years.[10]

While the observed stage of dental maturity can be very useful in forensic and other legal settings, the results mostly provide supporting information only. In this sense the method is comparable to other techniques describing the oral condition of the disaster victims.[11]

Conclusions

The full development age of third molars shows a mean gender discrepancy of about one year in the studied Indonesian population. Both genders reached the stage D of tooth development between 14 and 15 years of age on average. Males reached full stage H maturation at the of 22,5±3,0 years and females at the age of 23.5±3,6 years.

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Declaration of Interest

The authors report no conflict of interest.

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