

The Assessment of Tooth Apical Closure Between Males and Females of Indonesian Subjects Using Digital Panoramic Radiograph

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Abstract: *Background:* Tooth calcification is one of physiological maturation indicator for determine the growth of tooth maturation. Tooth calcification was an independent maturation and not influence by climate, nutrition, race, dental health, socio-economic, educational and health status. The aim of this study is to analyze the differences of the tooth apical closure between males and females of Indonesian subject. *Material and Methods:* This study was an observational study conducted as cross sectional study, the population was digital panoramic radiograph of patients who visiting Orthodontic Clinic Faculty of Dentistry Universitas Padjadjaran. The data consist of 229 digital panoramic radiographs of females age 8-18 years and 119 males, aged 9-18 years. Canine, first and second premolar, second and third molar of left lower jaw, was assessed using Demirjian's method. The differences between males and females was analysed using t-test (p-value <0.005). *Result:* tooth calcification in females earlier than males, with significantly differences for canines, first premolar, second premolar and third molar, no significant differences for second molar. *Conclusion:* Tooth apical closure in females earlier than males except for second molar.

Keyword: Tooth apical closure, Demirjian methods, Indonesian subjects

1. Introduction

The stage of dental development is one of important physiological maturation indicators in dentistry, such as in orthodontic, prosthodontic, endodontic, and in forensic dentistry. There are two types of dental development indicators for determine the stage of tooth maturation in relation to the chronological age, the first is tooth eruption and the second is the stage of tooth calcification. Tooth eruption is influenced by many factors such as climate, nutrition, race, dental health, socio-economic, educational and health status.^{1,2} Emergence is one of the process of tooth eruption, that often misunderstood with the eruption of teeth. The emergence of tooth to the gum can be influenced by many factors such as the presence of ankylosis, persistence of deciduous teeth, impacted or impeded of crowded teeth, whereas tooth calcification is an independent process.²

Tooth calcification is easy to observe on panoramic radiograph as diagnostic tools that commonly used in dentistry. We know that, Demirjian method is a most widely used for determining dental maturation. Up to now there were several studies have been undertaken for determined the differentiation of tooth calcification between males and females, especially the study of third molar calcification. Studies of third molar calcification have been undertaken in different population and in different race and ethnic group for estimation the chronological age of subjects at late adolescence or early adulthood.^{3,4,5,6} In this study we also assessing the differences of apical closure of third molar between males and females of Indonesian subject. The research of physiological maturation, shows that female mature 2 years earlier than male, but there were some variation in tooth calcification.^{7,8} For this reason, in this study

we will assess the differences of apical closure between males and females of Indonesian subject.

2. Material and Method

This study was an observational study, conducted as a cross-sectional study. The population was panoramic radiograph from 220 females and 109 males subject aged 8-17 years, from patients who visiting to Orthodontic Clinic Faculty of Dentistry, Universitas Padjadjaran. Inclusion criteria: Indonesian Deutero-malay race, without: history of systemic diseases, history of trauma of the face and jaw, any dental development disorder and extraction of lower permanent tooth. Tooth calcification was observed on panoramic radiograph on the left lower jaw, consist of 8 levels tooth calcification and the stage H is indicate to the apical closure. Panoramic radiograph was captured in digital format, and identification of apical closure was done on the computer.

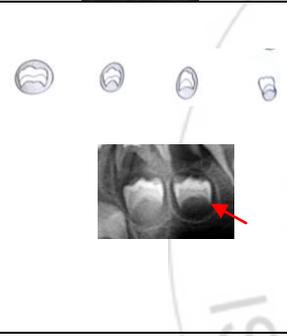
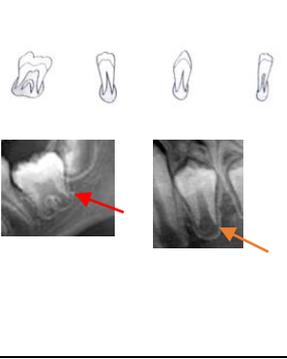


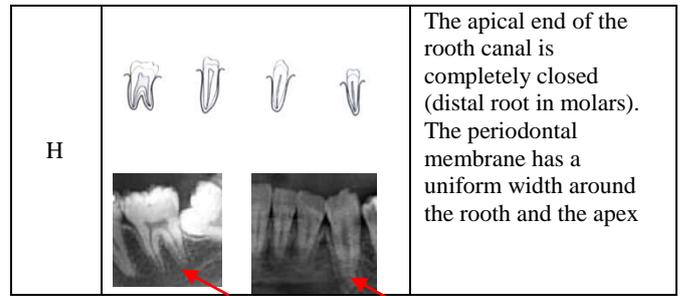
Figure 1: Digital Panoramic Photograph for Identification the Stage of Tooth Calcification.

Apical closure of canine, first premolar, second premolar, second and third molar of left mandibular was identified using Demirjian's method (1973) by one researcher. The intra examiner reliability was done by assessing 10 panoramic photograph three times at 7 days of interval. No significant differences between measurement. T-test was used to

analyzethe differences of apical closure between males and females subject (p-value<0.005).

Table 1: ToothCalcificationStage of Demirjian’s Method

Stage	Picture	Description
O		no evidence of calcification
A		cusps tips are calcified but have not yet fused
B		united of calcified cusp and outline of occlusal surface is well defined
C		enamel formation is complete at the occlusal surface. Dentinal deposition has commenced The outlines of the pulp chamber are curved
D		Crown formation is complete to cemento enamel junction. The pulp chamber in the uniradicular teeth being curve. Pulp chamber of molars has trapezoid form and the pulp horns are beginning to differentiate. Root formation is seen.
E		The wall of the pulp chamber are stright and the pulp horns are more differentiated. The rooth length is less than the crown height. In molar, the radicular bifurcation is visible.
F		The walls of the pulp chamber now form an isosceles triangle. The apex ends in funnel shape. The rooth lenght is equal to or greater that the crown height. In molars, the bifurcation has developed sufficiency to give the roots a distinct outline with funnel shaped endings.
G		The walls of the root canal are now parallel and its apical end is still partially open (distal root in molars)



3. Result

The result of this study, presented in the tables as follows:

Table 2: The Age Distribution of Males and Females Subject (years)

Stage	Female (age)	Male (age)	p-value
Stage F	15,92±0,675	15,95±0,998	0.740
Stage G	16,20±0,299	-	

Table 3: The Stage of Apical Closure (stage H) Between Females and Males Subject (Age)

Age (years)	Male (n)	Female (n)
8 – 8,9		6
9 - 9,9	11	27
10 – 10,9	24	26
11 – 11,9	16	37
12 – 12,9	12	28
13 – 13,9	18	32
14 – 14,9	9	29
15 – 15,9	12	19
16 – 16,9	7	16
Total	109	220

Table 4: The Stage of Third Molar Apical Closure (Stage H) of Females and Males Subject

Tooth	Female (age/years)	Male (age/years)	Differences in year	p-value*
Canine	13,75 ±1,595	14,80 ± 1,554	1.05	0.000*
First Premolar	14,02 ±1,531	14,81 ± 1,511	0.79	0.004*
Second Premolar	14,33 ±1,427	15,02±1,509	0.69	0.013*
Second Molar	15,20 ±1,034	15,69±1,257	0.49	0.093

Results showed, there is no significant difference of apical closure of canine, first premolar and second premolar, and significant difference of second molar. For third molar, both females and males reached different stage of tooth calcification. Females has reached stage G at 16,20 years while males subject stage F at 15,95 years. This results indicate that the stage of third molar calcification females mature earlier than males.

4. Discussion

Human growth is less appropriate if it is determined by chronological age, because chronological age does not always give the real of growth stage⁷. Biological changes at prepubertal growth periode occurs as weight, height, ossification of the bones, appearance of secondary sex character and eruption of the teeth. The accuracy of growth determination is much more accurate up to 20 years of age, and drastically decline after this age.⁹The development of

tooth this parallel with others structure of the body. Research shows that the development of the tooth is more related to the chronological age than to the other growth indicators such as height, weight, sex and skeletal maturation indicators¹⁰ In orthodontic, the development of tooth is very important, which is the maturation and eruption of the tooth plays an important role in masticatory function and the growth of alveolar bone. The growth of maxillary and mandibular alveolar bone effect on vertical growth of naso-maxillary complex, as well as vertical growth of mandibular condyle.¹¹

The assessment of tooth calcification stage was done on digital panoramic radiograph and determination the level of apical closure was done in computer. The advantage of digital panoramic radiograph to determine the stage of tooth calcification are: clearly visible, more easier than manufacturing of intra-oral dental radiograph, require less radiation than X-rays "full mouth" and the distortion on mandibular panoramic radiograph was not a problem, because Demirjian's scoring system determined based on scoring criteria, not based on absolute value (rating system). Panoramic radiographs due to their ability to enhance a wide view of the tooth and facial bones are one of the best instruments to assess dental calcification^{12,1} By using computer, the area of tooth calcification could be enlarged, sharpened, and if necessary could be invert so that the stage of calcification become clearer^{13,5} Determination the stage of tooth calcification was not carried out on the maxilla, because the posterior teeth of the maxilla overlapping with bone structures, and the accuracy was difficult^{1,3}.

In this study, the central incisor, lateral incisor and first molar was not included in this research, because the apical closure had been completed. Demirjian's method consists of eight levels of tooth calcification with each tooth calcification stage were coded A to H, starting from the deposition email at the crown of the tooth, tooth root calcification rates, and changes in pulp cavity to form a complete root formation. Stage A indicates the earliest levels of tooth calcification, while stage H indicate the closure of apical root. If there are missing teeth, it can be replaced by the same tooth on the right side of the lower jaw. Demirjian's scoring system is universal, so it can be used in all populations. Research indicate that growth of height, skeletal maturation, dental calcification rates, and sexual maturation runs parallel with the chronological age, but the growth of height, skeletal maturation, and sexual maturation have higher correlation than correlation of dental maturation with other growth index⁸. In order to assess dental maturation, tooth calcification due to progressive and continuous process it can be followed on panoramic radiograph.

Table 2, shows there were 6 female subject in group 8-8.9 years, and males are non. Table 3, there were significant differences of apical closure of canine, first premolar, second premolar between females and males, which is apical closure of canine in female 1.05 years earlier than male, first premolar females 0,79 years earlier than males, and second premolars females earlier 0,69 years than males. No significant differences for apical closure of second molar between females and males ($p > 0.05$).

Table 4, show third molar apical closure has not occurred both females and males. No significant difference the stage G between males and females ($p > 0.05$). Females has reached stage G earlier than male. It is known that in skeletal maturation, females mature 2 years earlier than male⁷. Skeletal maturation of Indonesian subject showed that females mature 1,49 years earlier than male¹⁴ This study shows that apical closure in females earlier than males, and this result is in accordance to the skeletal maturation of Indonesian subjects which is females mature earlier than males.

Recently, calcification stage of third molar was used as feasible biological tools for estimating chronological age, from juvenile to adult status^{5,15,16} The study of black African Brazilians population, shows that third molar calcification of females mature earlier than males⁴, but other research shows that males mature earlier than females^{4,18}. Research in North Indian showed that third molar calcification in females also earlier than males¹⁹. The study of Attar et al, shows that the third molar calcification males reached at stage E while females reached at stage D²⁰. In this study, canine, first premolars, second premolars, molars second and third molars, females earlier than males. The differences of the results could be due to differences in sample size, methodology, geographic, race, and ethnicity.

5. Conclusion

There are significant differences of apical closure of canine, first premolar and second premolar, between females and males, which is females earlier than males. There is no significant differences of apical closure of second molar between females and males subject. For third molar both females and males not yet reach apical closure and females reach at stage G, while males reached at stage F.

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