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**PROGRAM
BOOK**

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$$15 \times 0,40 = 6/6 = 1$$

DENTAL AGE ESTIMATION USING SCHOUR AND MASSLER METHOD

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ABSTRACT

Background: Dental age estimation method using a diagram of tooth development and formation of the crown / root specific gear is a non-invasive method. Diagram of the most widely known is a diagram Schour and Massler (1941a and 1941b) which contains 21 images from the series of dental development in the fetus to adult.

Objective: To determine the estimated age of patient assessment using Schour and Massler based at the RSGM Unhas panoramic photo.

Methods: This study used a cross-sectional study design comparing kronologis age and age estimation based on diagram Schour and Massler. Thirty samples of panoramic photos of patients aged 6-11 years was obtained from the medical records of RSGM Unhas Makassar.

Results: Of the 30 total samples, as many as 15 people (50%) have estimated the same age with chronological age, as many as 7 people (23.3%) had estimated lifespan is smaller than chronological age, and as many as 8 people (26.7%) had estimated lifespan is greater than chronological age.

Conclusions: The method Schour and Massler quite accurate in estimating human chronological age, especially in pediatric patients.

Keywords: Dental age estimation, Schour and Massler method.

Background

Dental eruption can be the guiding age of a person in a social and clinical context. In recent years, dental observations have been used to predict the biological age of children without birth documentation.^{1,2} A number of researchers pay close attention to methods and techniques for estimating one's age based on anatomical changes and tooth structure or comparing dentiform radiographic images with progression the existing tooth.^{2,3,4}

In 1941 Schour introduced a diagram describing the development of teeth from the clinical status of 25 patients. Furthermore, Kahl in 1988 updated the diagram based on an analysis of 993 panoramic radiographs. Modified diagrams describe the development of teeth that specifically distinguish the gender. The data became the gold standard in determining modern life.

Dental age estimation method using dental development chart and formation of certain dental crown / root is one of non invasive method. The most widely recognized diagrams are the Schour and Massler diagrams (1941a and 1941b) which contain 21 images of dental development series ranging from inside the fetus to adults.⁶ This method uses radiography to evaluate crown calcification, root and apex development and tooth eruption patterns. This dental development chart is easy to use because it compares directly between tooth radiographs or tooth isolates with a dental development table chart.⁷

Research methods

The type of this research is observational analytic, that is research which explains the relationship between variables through hypothesis testing. The design of this research is cross sectional study which is a design studying the correlation / association dynamics between independent variables and the dependent variable at the same time (point time approach). This research conducted in the Radiology Departement of Dental and Oral Hospital (RSGM)

Unhas, st.Kandea, Makassar. The study was conducted from June to August 2016 by using a nominal scale for chronological age estimation using the Schour and Masseler method.

Operational Definition and Objective Criteria

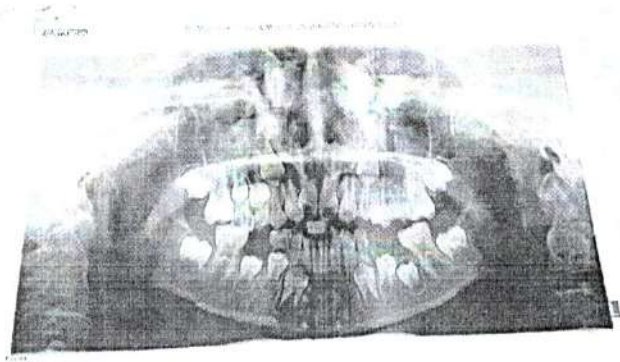
- Age estimation is an approximate chronological age of a person by using a Schour and Masseler diagram.
- Chronological age is the age of someone written on The Oral and Dental hospital (RSGM) UNHAS medical record.
- Panoramic Dental Photos is a dental radiograph image showing all the teeth in the upper and lower jaws in one area obtained from the Oral and Dental hospital (RSGM) UNHAS radiograph of radiographic parts and positively printed on photo paper.
- Schour and Masseler Method is an age estimation method which is a developmental chart of the teeth ranging from prenatal to age 12 years, 15 years.
- Objective Criteria

The comparison between chronological age and estimated age was assessed by criteria:

- a. Fast is the estimated age smaller than the chronological age
- b. Normal is estimated age equal to chronological age
- c. Slow is the estimated age greater than the chronological age

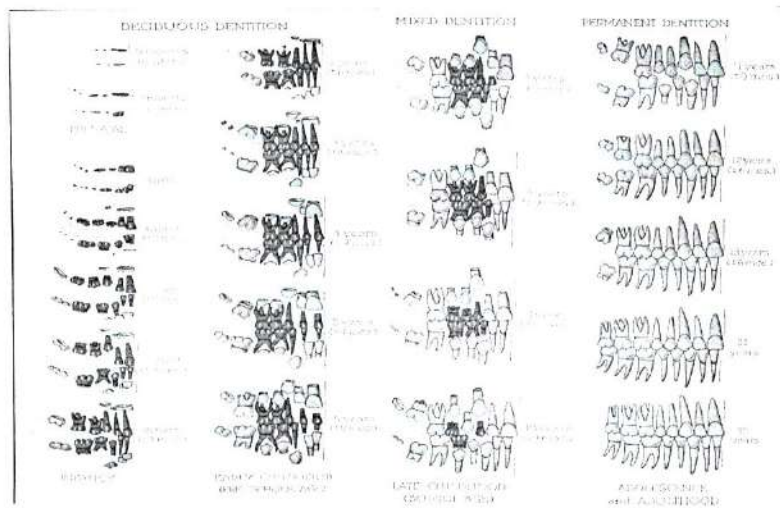
Population: Radiology patients of Oral and Dental hospital (RSGM) UNHAS.

Sample: The sample of this study amounted to 30 samples with age range 6-11 years.



Gambar 1. Panoramic radiograph

(source: personal document)



Gambar 2. Schour and Masseler tooth development diagram

(Source: World Journal of Pharmaceutical and Medical Research: Age estimation in forensic odontology)

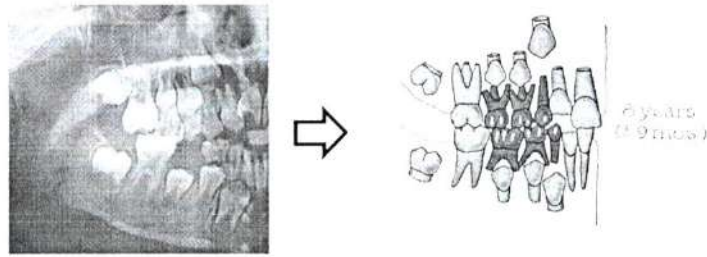


Figure 3. Observation by comparing panoramic photograph with tooth development diagram in order to get estimated age.

- Measurement Methods: The measurement method is to compare between dental panoramic photos with teeth developmental charts of Schour and Masseler.
- Data Type: The type of data used is secondary data.
- Data Processing: Data processing of this research using SPSS v.16 software
- Statistical Test: This research uses T test and Regression Test

Research result

This study used 30 panoramic photographs of 6-11 year old samples collected from June - August 2016 from radiology department of RSGM Unhas. The medical record data used for this study include chronological age (in years) and sex. Radiographic images are positively imprinted on photo paper so that researchers do not require spotlight to observe the size and shape of the teeth. Characteristics used in assessing the age of a person using the Schour and Masseler method are crown calcification, root and apex development and eruption patterns of teeth.

The sample consists of 12 boys with the youngest chronological age is 7 years and the oldest is 11 years old. The girls were 18 samples with the youngest chronological age of 6 years old and the oldest was 11 years old. Based on the developmental development chart of

teeth made by Schour and Masseler, the estimated age of boys ranged between 7-10 years and girls between 6-12.

Distribution of sample by age category can be seen in table 1 below. Number of samples with chronological age of 6 years: 3 people (10%), 7 years: 6 people (20%), 8 years: 8 people (26.7%), 9 years: 8 people (26.7%), 10 years: 2 people (6.7%) and 11 years: 3 people (10%). Number of samples with estimated age of 6 years: 2 persons (6.7%), 7 years: 9 people (30%), 8 years: 7 people (23.3%), 9 years: 5 people (16.7%), 10 years: 3 people (10%), 11 years: 2 persons (6.7%) and 12 years: 2 people (6.7%).

Table 1. Chronological age and estimated age distribution

Age (years)	Chronological age		Age estimation	
	N	%	N	%
6	3	10.0	2	6.7
7	6	20.0	9	30.0
8	8	26.7	7	23.3
9	8	26.7	5	16.7
10	2	6.7	3	10.0
11	3	10.0	2	6.7
12	0	0.00	2	6.7
total	30	100.0	30	100.0

Source: primary and secondary data

In Table 2. Overall, there were 7 samples (23.3%) which showed faster, 15 samples (50.0%) showed the same age (normal) with chronological age and 8 samples (26.7%) expressed the estimated age slower than chronological age. In terms of gender, 3 (25.0%) boys showed rapid development, 5 (41.7%) of boys showed

normal development, and 4 (33.3%) of boys showed slow progress. The girls of 4 (22.2%) of children showed a slow and rapid development of teeth and as many as 10 (55.6%) children had normal development.

Table 2. Sex distribution and tooth development category based on estimated age.

Sex	Category of dental development			Total
	Fast (%)	Normal (%)	Slow (%)	
Male	3 (25.0)	5 (41.7)	4(33.3)	12 (100)
Female	4 (22.2)	10 (55.6)	4 (22.2)	18 (100)
total	7 (23.3)	15 (50.0)	8 (26.7)	30 (100)

Source: primary data

The result of bivariate analysis between chronological age and dental development category based on estimated age was obtained as follows:

Table 3. Bivariate analysis between chronological age and dental development category based on estimated age.

Chronologica l age (years)	Category of dental development according to the estimated age of Schour and Masseler			Total
	Fast (%)	Normal (%)	Slow (%)	
6	1 (33.3)	2 (66.7)	0 (00.0)	3 (100)
7	1 (16.7)	5 (83.3)	0 (00.0)	6 (100)
8	0 (00.0)	5 (62.5)	3 (37.5)	8 (100)
9	3 (37.5)	3 (37.5)	2 (25.0)	8 (100)
10	1 (50.0)	0 (00.0)	1 (50.0)	2 (100)
11	1 (33.3)	0 (00.0)	2 (66.7)	3 (100)
Total	7 (23.3)	15 (50.0)	8 (26.7)	30 (100)

Source: primary data

Based on the above, it can be seen that the Schour and Masseler method can predict the age of children by 50% or 15 samples. The largest age of estimation has correspondence with chronology age is age 6 and 7 years, respectively 66.7% (age 6 years) and 83.3% (age 7 years).

Table 4. Comparison of chronological age and estimated age by sex

Sex		N	Min	Max	Mean	SD	Diff	<i>p value</i>
Male	Age estimation	12	7	10	8.5	1.1 7	0.00	1.000
	Chronological age	12	7	11	8.5	1.1 7		
Female	Age estimation	18	6	12	8.33	1.9 4	0.17	0.779
	Chronological age	18	6	11	8.17	1.5 8		

Table 4 shows that the difference between chronological age and estimated age in boys are 1.00 and girls are 0.779. The two differences are not significant but the meaninglessness indicates that the age estimation method of children using Schour and Masseler diagrams gives an age estimate that is not different from chronological age. The mean and the mean difference between estimated age and chronological age are presented in table 5 below:

Table 5. The mean and the mean difference between estimated age and chronological age

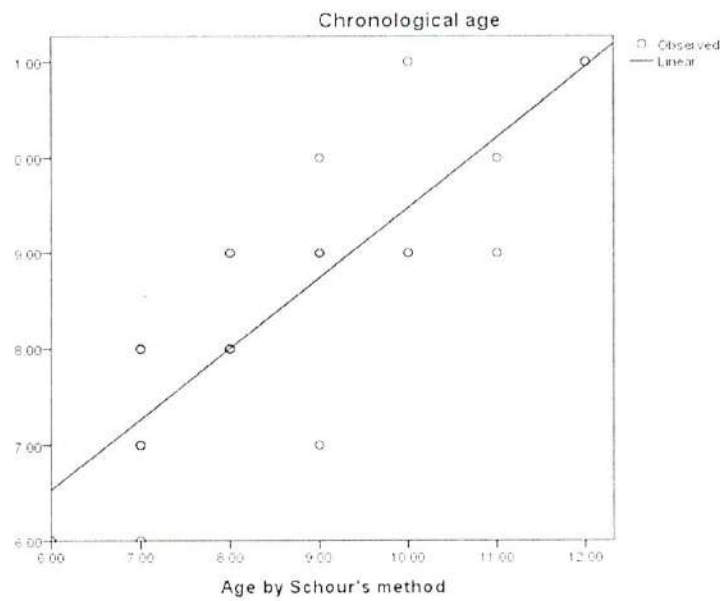
	N	min	max	mean	SD	Diff	p value
Age estimation	30	6	12	8.4	1.653	0.100	0.802
Chronological age	30	6	11	8.3	1.418		(NS)

Based on table 5 it can be seen that the overall difference between chronological age and age of estimation is not significant with value = 0.802. This meaninglessness shows that for all samples, the use of Schour and Masseler method can be used to estimate the chronological age of the child because the difference between the two is not significant. As for assessing the significance of the use of Schour and Masseler method to apply and be used as reference in the same population specially in sampling area then used regression analysis as presented in table 6. Estimation of children age using Schour and Masseler method can be used to estimate chronological age because the result of analysis obtained p value = 0.000.

Table 6. Regression analysis of age estimation of Schour and Masseler method

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	2.470	.860		2.872	.008
Sex	-.211	.277	-.074	-.761	.453
Age by Schour's method		.084	.856	8.779	.000

The following graph illustrates the distribution of samples according to the regression analysis.



Gambar 4. Regression analysis graphic.

To find out the extent to which this research data can be accepted by the regression equation it is necessary to analyze Intraclass Correlation Coefficient as presented in Table 7 below:

Table 7.Intraclass Correlation Coefficient (ICC)

ICC	95% CI			
	Lower Bound	Upper Bound	Nilai <i>p</i>	S
0.646	0.352	0.820	0.000	S
Interpretation of ICC				
< 0.40	<i>Poor agreement</i>			
0.4 – 0.55	<i>Fair agreement</i>			
0.56-0.75	<i>Moderate agreement</i>			
0.76 – 0.85	<i>Good agreement</i>			
>0.85	<i>Excellent agreement</i>			

The result of ICC analysis above illustrates that the acceptance of Schour and Masseler method is 0.646 which means it is good enough to be applied as a method of estimating the chronological age of a child with $pp = 0.000$. The equation for estimating the chronological age of children in similar populations can be performed using the following formula:

$$\text{Chronological age} = 2.470 - 0.211 * \text{sex} + 0.734 * \text{estimanted aged of Schour and Masseler method.}$$

Discussion

There are several ways to estimate age in children, one of which is using developmental charts of Schour and Masseler teeth which is also the oldest method of estimating age. To assess tooth age, crown and root development, and eruption status in the specimens were adjusted with the diagrams in the table. There is rarely an appropriate match but the closest stages are selected. Schour and Masseler diagrams were originally used as dentist guides but have also been used extensively.⁸ Schour and Masseler diagrams were used

to estimate tooth age in dental development. The diagram contains a direct comparison with the radiographic representation.⁹

This study was conducted to determine whether the Schour and Masseler method can estimate the chronological age of humans based on panoramic images of teeth in the 6-11 year age range. Assessment of the accuracy of this method is to group into 3 categories of dental development that is fast, normal and slow. Rapid categories are estimated age smaller than chronological age. The normal category is the estimated age equal to the chronological age. The slow category is more than chronological age.

The results of this study indicate that half of the samples show the suitability between chronological age and estimated age. In addition, older girls showed a match between chronological age and estimated age of 55%. In a study conducted by Ebrahim et al (2014) it was found that although there was a correspondence between chronological age and estimated age, the difference between the two assessments was not significant, meaning that the Schour and Masseler methods could be used well.¹

The research conducted by AlQahtani, et al. (2014) comparing three methods of examination between the Schour and Masseler methods, Uberlake and London Atlas found that the London Atlas method as a newer method is more accurate and has greater precision.¹⁰ The authors state that few evaluate estimated age using the Schour and Masseler. Miles (158) in AlQahtani (2014) states that samples above the age of 12 years then the estimate of age is much different from the actual chronological age. Two separate studies suggest that better accuracy of Schour and Masseler methods is used for infants and toddlers than children and adolescents. The first study states that the Schour and Masseler methods estimate age with an average difference of -0.11 years (SD 0.30 years) to 63 samples aged 0-5.4 years. The second study in modern European groups reported mean differences between tooth age and chronological age of -0.66 for the Schour and Masseler methods and -0.71 using the Uberlake

method. The sample size in the second study was very large (N = 419). Both reports provide conclusions about the accuracy of the assessment using age estimation diagrams.¹⁰

Comparison of accuracy with different approaches is problematic. Diagrams and dental atlas represent visual ratings of teeth by age. Specific dental methods to age at the developmental stage of each tooth can be used to predict age. The AlQahtani study states that the Atlas London method is better than Schour and Masseler and Uberlake.¹⁰

This study generally indicate that the assessment between estimated age and chronological age has a difference of 50%. Based on correlation coefficient analysis, the value of acceptability is in the medium range, in contrast to research Ebrahim et al (2014) which has a very good acceptance value. Possible explanations for this difference include the determination of chronological age based on the sample medical records in this study using the year number only while the assessment in the Ebrahim study, et al (2014) distinguishes the chronological age of the sample using years and months. The difference of nine months and one month at the age of the same year is very significant in the development and eruption of teeth, especially at the age of the children.

CONCLUSION

The Schour and Masseler method is a fairly straightforward method to apply in estimating the chronological age of humans because it compares only the panoramic image of the tooth with the teeth developmental diagram of Schour and Masseler.

Based on this research, it is found that the Schour and Masseler method has a good accuracy of 50% and can be applied in estimating chronological age of human especially in children with age range 0-12 year. Whereas if this method is applied to adult individuals will get difficulty that is limited development of tooth diagram because not all adult age there is only age 15 years, 21 years and 35 years.

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