Scholars Journal of Applied Medical Sciences (SJAMS) **ISSN 2320-6691 (Online)**
Sch. J. App. Med. Sci., 2014; 2(5C):1669-1674 **ISSN 2347-954X (Print)**

(An International Publisher for Academic and Scientific Resources)
www.saspublishers.com **DOI:** 10.36347/sjams.2014.v02i05.036

Research Article

Dental Age Estimation Using Schour and Massler Method in South Indian Children

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Abstract: Teeth are the most indestructible part of human body, they preserve well in traumatic settings hence developing teeth are used most reliably in age estimation. The present study was conducted to estimate the age in South Indian children using Schour and Massler method and to evaluate the efficacy of this method by comparing with the chronologic age. The study group comprised of 25 healthy children of 5-16yearsage. Dental age was assessed by directly comparing the tooth development stages on panoramic radiographs with the standards using Schour and Massler chart. Data were analyzed by using paired t-test and intraclass correlation coefficient using SPSS 13 statistical software. The Intraclass correlation coefficient was 0.938 which shows high agreement between the chronologic age and dental age by Schour and Massler's. The two methods were found to be highly significant. In conclusion, Schour and Massler method was reliable for age estimation in South Indian children. This method of age estimation is simple and accurate and can be applied both in males and females. A new regression formula for the prediction of dental age in South Indian population was developed based on the Schour and Massler method.
Keywords: Dental age, Schour and Massler method, Regression equation.

INTRODUCTION

Forensic odontology has been with us since the beginning as the history of bite mark evidence and hence the forensic dentistry began with the eating of forbidden fruit in the garden of Eden [1]. The modern forensic case started in 1897 in disaster victim identification in Paris which was performed by a general dentist [2]. Federation Dentaire Internationale (FDI) defined forensic dentistry as the branch of dentistry in the interest of justice deals with proper handling and examination of dental evidence with the proper evaluation and presentation of dental findings [3, 4]. The field of forensic dentistry or the more specific term, forensic odontology, is the application of dentistry to the law. Forensic dentistry includes multiple areas of scientific study, where the law and dentistry coincide. This specialized area of dentistry includes collecting and interpretation of dental evidences within the overall field of criminalistics [1]. Many criminal cases have been solved by using a person's dental record or by the identification and analysis of bite-marks on an object or on victim's body or the estimation of a person's age based upon dental development or other characteristics [5, 6]. Dental radiographs have been used in age estimation since 1982.Just one year after the discovery of the X-ray by Roentgen that is in 1896 application of radiology in forensic sciences was introduced, to demonstrate the presence of lead bullets inside the head of a victim [7].

Age estimation using dental radiography is an important aspect of forensic odontology. The method of age estimation using dental development sequence are more accurate than by using skeletal development, as dental development to a greater extend is controlled by genes and less affected by environmental factors. Various radiographic images that can be used in age identification are intraoral periapical radiographs, lateral oblique radiographs, panoramic radiographs, cephalometric radiographs, digital imaging and advanced imaging technologies [8, 9]. Schour and Massler method was introduced in 1941.They studied the development of deciduous and permanent teeth, describing 21 chronological steps from 4 months to 21 years of age and published the numerical development charts for them. Here they compared the calcification stages of teeth on radiographs with the standards. The American Dental Association (ADA) has periodically updated these charts and published them in 1982.They have their origin work by Logan and Kronfield which was carried out in 1933 [7, 10, 11].

The present study was aimed at estimating the age in children using Schour and Massler method and to evaluate the efficacy of this method by comparing with the chronologic age of the patient.

MATERIALS AND METHODS

The present study was conducted in the department of Oral medicine and Radiology of our dental college and hospital. The patients were selected from the out patients attending the department of Oral medicine &Radiology. The study group comprised of 25 healthy children in the age group of 5-16years.Children with no agenesis of teeth, teeth with root development complete or incomplete, apical ends of the roots completely closed or not and crown formation complete or incomplete were included in the study. Only good quality radiographs were taken for the study. Medically compromised patients and children with developmental anomalies like hypodontia or hyperdontia were excluded.

A standard protocol was followed to examine the patient and the necessary details were recorded using a prepared case history format. Patients were then subjected to digital panoramic radiograph (PlanmecaPromax) using phosphor plates and the images were scanned using Agfa CR 30-X. Images were recorded on computer files, processed by computer aided drafting program Agfa –NX. Chronologic age (date of birth) and date of radiograph was recorded. Age estimation was done by directly comparing the tooth development stages on panoramic radiographs with the standards using Schour and Massler chart (Fig. 1 and Fig. 2). Parameters were recorded in a descriptive statistical manner and evaluated (Table 1). Mean values were compared using paired t test and intra class correlation coefficient. Regression analysis was done using SPSS 13 software for the prediction of chronologic age and obtained dental age.

Fig. 1: Dental development chart by Schour and Massler showing deciduous dentition [7]

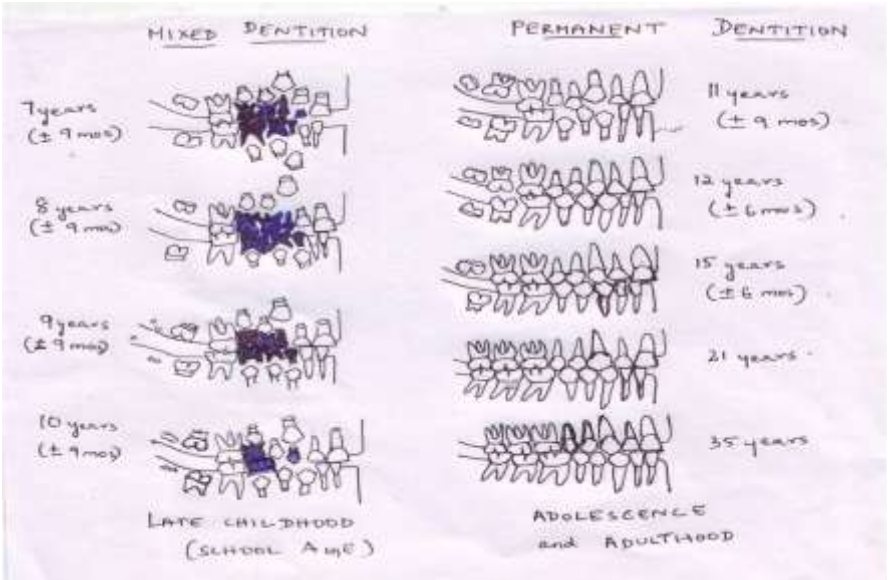

Fig. 2: Dental development chart by Schour and Massler showing mixed and permanent dentition [12]

RESULTS

This study population consisted of 25 children within the age group 5-16years, of which 15 are males and 10 are females. Among the males, lowest chronologic age was 5years and highest age was 14years and among the females it was 7 and 16 years respectively (Table 1). The age obtained by Schour and Massler method in this study was found to be higher than the chronologic age in5 children (3males and 2 females), the obtained dental age was approximately same as that of the chronologic age in 10 children (5males and 5 females) and the age obtained was less than the chronologic age in 10 children(7 males and 3 females).Statistically there was no significant difference between chronologic age and the age by Schour and Massler method ($p<0.1$) (Table 2 & 3).

The Intra class correlation coefficient was 0.938 which shows high agreement between the two methods. The chronologic age and dental age by Schour and Massler method was found to be highly significant (Table 4 & Fig. 3). The regression formula derived which can be used to determine the age in South Indian children (Table 5).

Chronological age = 0.816 + 0.958*Age by Schour's method + 0.202* Gender (Gender – Male then substitute as 1, for female substitute as 0)

Table 1: Gender distribution

Sl. No.	Gender	Chronological age (years)	Age by Schour's method (years)
1	M	8.1	9±6
2	M	13.4	15±6
3	M	5.1	5±6
4	M	11.8	10±6
5	M	11.6	10±6
6	M	11.10	11±6
7	M	10.3	11±6
8	M	10.1	9±6
9	M	13.1	11±6
10	M	10.1	8±6
11	M	7.5	7±6
12	M	11.3	11±6
13	M	10.11	9±6
14	M	8.5	8±6
15	M	12.1	11±6
16	F	8.5	8±6
17	F	10.11	10±6
18	F	12.1	10±6
19	F	11.1	10±6
20	F	16	15±6
21	F	8.4	9±6
22	F	8.2	9±6
23	F	8.3	8±6
24	F	11.2	11±6
25	F	7.2	7±6

Table 2: Comparison of chronologic age and age by Schour's method for males and females

Gender		N	Minimum	Maximum	Mean	Std. deviation	diff	t value	p value
Female	Age by Schour's method(years)	10	7	15	9.70	2.21	.41	1.546	.157
	Chronological age (years)	10	7.2	16.0	10.11	2.62			NS
Male	Age by Schour's method(years)	15	5	15	9.67	2.29	.61	1.952	.059
	Chronological age (years)	15	5.1	13.4	10.28	2.23			NS

Table 3: Means and mean differences between the chronologic age and age obtained using Schour's method

	N	Minimum	Maximum	Mean	Std. deviation n	Diff.	t value	p value
Age by Schour's method(years)	25	5	15	9.68	2.21	.53	1.681	.101
Chronological age (years)	25	5.1	16.0	10.21	2.34			NS

Table 4: Intra class correlation coefficient

Intraclass Correlation [ICC]	95%Confidence Interval			
	Lower Bound	Upper Bound	p	
.938	.827	.975	.000	HS
Interpretation of ICC				
< 0.40	Poor agreement			
.4 -- .75	Fair agreement			
.75 -- .85	Good agreement			
> 0.85	Excellent agreement			

Table 5: Results of regression analysis

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	p
(Constant)	.816	.976		.837	.412
Age by Schour's Method (years)	.958	.095	.906	10.102	.000
Gender	.202	.420	.043	.480	.636

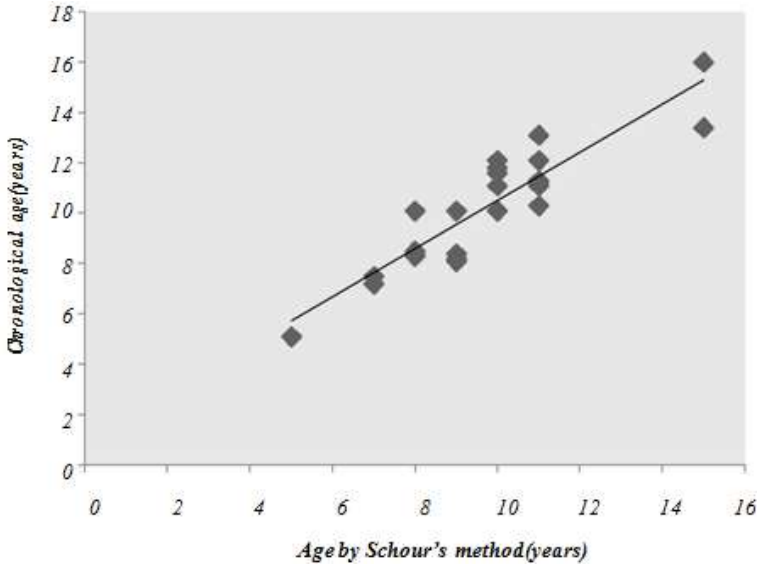

Fig. 3: Graphical presentation of intra class correlation coefficient

DISCUSSION

Schour and Massler method of age estimation is the oldest method of all. To assign a dental age, the development of crowns and roots, and state of eruption, in the specimen are matched against the diagrams in the chart [13]. It is rare to find a perfect match, but the closest stage is chosen. Schour and Massler chart was derived from the clinical status of 25 patients. It was originally intended just as a guide for dentists, but it is also widely used for the age estimation in archaeology [14, 15]. There are certain drawbacks for Schour and Massler method that these charts do not have separate surveys for males and females, and the mean age range of 2–5 years is put at 6 months and is thus too narrow. Ublekar later widen these ranges in the chart. Regardless of these drawbacks, these charts are being used commonly in age determination. The origins of the age ranges given in the Schour and Massler chart are

slightly mysterious although they probably lie in the studies of Logan & Kronfeld, who made histological sections of the jaws of a relatively small number of children [16, 17].

In 1988 Kahl updated the findings of Schour and Massler based on the analysis of 993 panoramic radiographs. In addition a gender-specific chart of the development of the dentition was introduced. These data still represent the gold standard for modern age determination [18].

A. E. W. Miles [20], in his study to ensure that the data given in Schour and Massler table hold good for English children and to test the accuracy with which age could be assessed by it, the ages of 58 children were estimated from lateral jaw radiographs of the cheek teeth, solely with the aid of the Schour and Massler table. Comparison of the real and estimated ages was done.

In the present study the age of 25 Indian children were estimated from panoramic radiographs. Miles reported that in his study up to the age of about 12 years most estimates fall near the real age, few being more than a year out. Above the age of 12 years, however, there is an increasing amount of scatter and many are two years or more above or below the line. Although the sample was too small for any definite conclusions to be drawn, the fact that the estimates fall about equally above and below the line suggests that the table of Schour and Massler is accurate for English children.

In this study, up to the age of 12 years, four children shows an overestimation of ≈1yrs ± 6 months, ten children shows approximately the same age as that of the chronologic age and eight children shows an underestimation of ≈1yrs ± 6 months. Only three children are above the age of 12 years, out of which two estimates falls below and one above the real age. The intra class correlation coefficient between the age by Schour's method and chronologic age was found to be statistically highly significant ($p<0.000$).

In later childhood, there is a considerable range of variation in the chronology of tooth development. It may be significant that over the age of 16 years the estimates tend to fall consistently too low and it is possible that the table needs some correction for the chronology of development of the third molars [19, 20].

CONCLUSION

There are several factors which influence dental age assessment. Accuracy, precision and simplicity are the important requirements for an age assessment method. Schour and Massler method is a non-invasive method. Unlike other methods it does not require time consuming calculations. It is a simple method hence more commonly used in age determination. Based on the results of the present study, Schour and Massler method is sufficiently accurate to estimate dental age of children (5-16years) and can be used acceptably.

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