

The Efficacy of Demirjian's Method and Mito ET AL Method in Age Estimation – A Comparative Study

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Abstract: Aim And Objective: This study aims to compare the age obtained by Demirjian's method and Mito et al method with the chronological age of the individual and to evaluate the efficacy of these methods in determining the age of an individual in South Indian population.

Materials And Methods: Digital panoramic radiographs and lateral cephalograms of 100 individuals in the age group of 7-15 years, were selected. Dental age was calculated using Demirjian's method, and skeletal age using Mito et al method and it was then compared with the chronological age of the study population. The data obtained were subjected to statistical analysis using student' t test and Spearmans rank order correlation coefficient.

Results: The results revealed a high correlation between the chronologic age and age obtained by Demirjian's method in both males and females. In Mito et al method good correlation was found between chronologic age and skeletal age in females only.

Key Words: Orthopantomograph, Lateral cephalograph, dental age, skeletal age, Demirjian's method, Mito et al method.

Date of Submission: 13-07-2019

Date of acceptance: 29-07-2019

I. Introduction

Age estimation has a multitude of uses in person identification, forensic dentistry and in assessing the appropriate age for initiation of the orthodontic treatment.. Parameters such as body height and weight, menarche or voice changes, secondary sexual characteristics, dental and skeletal development are the biological indicators of physiological maturity. Of these parameters, the dental and skeletal development were found to assesses the somatic maturity in close correlation with the chronological age in evaluating an adolescent's physical development¹Dental age estimation is important for pediatric dentists and orthodontists in planning and timing treatment, and selecting the appropriate orthodontic appliance², which can be done by observing the timing of eruption of teeth clinically or by assessing the degree of mineralisation of the developing teeth from radiographs³. Many authors have developed scoring methods based on the radiographic evaluation of dental calcification of permanent teeth, including Demirjian, Nolla, Goldstein, and Van der Linden, among which the most widely used dental maturity scaling system is the method developed by Demirjian in 1973 on a sample of French - Canadian children^{4,5}. The classical and the most widely used method for skeletal age estimation is the hand wrist analysis done using hand wrist radiograph, whose validity has been confirmed by many studies^{6,7}. But the problem with this method is it entails an additional radiation exposure in addition to the routine radiographic records required for an orthodontic patient. Cervical Vertebral Maturity (CVM) staging is being used widely to assess the skeletal age due to its simplicity, objectivity and repeatability and because of the availability of lateral cephalograms in all patients¹ Mito et al was one among the authors who tried to establish a new method for objectively evaluating skeletal maturation in cephalometric radiographs by assessing the cervical vertebrae and derived a regression formula for obtaining cervical vertebral bone age in Japanese population. The present study aims to compare the dental age obtained by Demirjian's method, the skeletal age obtained by Mito et al method with the chronological age of the individual and evaluate the efficacy of these methods in determining the age of an individual in the study population.

AIMS & OBJECTIVES : To compare the efficacy of Demirjian and Mito et al method in determining the age of an individual in South Indian population.

II. Materials And Method

This retrospective study was done in our department, Mangalore. Digital panoramic radiographs and lateral cephalographs of 100 individuals (50 females, 50 males) within the age group of 7-15 years, in whom all the seven left mandibular teeth were present, and whose third and fourth cervical vertebrae can be visualised completely in the lateral cephalographs along with the clinical records were selected for the study. The radiographs which showed any developmental anomalies were excluded from the study. The radiographs selected were taken for various other reasons and it was retrieved from the database (archives). The dental age estimation was done using the Demirjian's radiographic method of age estimation.⁴ The teeth assessed were mandibular seven left permanent teeth in following order: 2nd molar, 1st molar, 2nd bicuspid, 1st bicuspid, canine, lateral incisor, central incisor. All teeth are rated on a scale A to H. Each tooth is given a score depending on its stage and the scores on all teeth are added together to give a total maturity score which can be converted directly into a dental age using an appropriate table of standards. The cervical vertebral maturity assessment was done using Mito et al radiographic method by measuring the following parameters of the cervical vertebrae C3 and C4 i.e the anterior vertebral body height(AH), posterior vertebral body height(PH) and anteroposterior body length(AP) and substituting in the regression formula given by Mito et al.⁸ (Fig 1). The vertebral bone age was calculated using the regression formula

$$\text{Cervical vertebral bone age} = -0.20 + 6.20 \times \text{AH3} / \text{AP3} + 5.90 \times \text{AH4} / \text{AP4} + 4.74 \times \text{AH4} / \text{PH4}$$

After assessing the dental age and vertebral bone age, it was compared with the chronologic age of the individual. The data was subjected to statistical analysis using students t test and Spearman rank order correlation coefficient. Spearman rank-order correlation coefficients were used to measure the association between the skeletal maturity and dental maturity with the chronologic age and the statistical significance of the correlation tabulated. Student t test was used to calculate the separate skeletal and dental maturity in the male and female groups and the results tabulated.

III. Results And Observations

This study comprised of 100 patients between the age group of 7-15 years. Frequency in gender distribution is shown in Table 1. In dental age estimation using Demirjian's method, the mean dental age in males is 14.1480 with a standard deviation of 1.76673 and the mean dental age in females is 13.9660 with a standard deviation of 1.67352. The mean chronological age in males is 13.3186 with a standard deviation of 1.57073 and the mean chronological age in females is 13.1620 with a standard deviation of 1.66175. An overall comparison of chronological age and Demirjian's method is shown in Fig.2. Intraclass correlation coefficient was 0.891 for females which showed excellent agreement (>0.85), for males ICC was 0.779 which showed moderate agreement. No significant difference was seen between chronological age and dental age with Demirjian's method both in males and females.

The skeletal age estimation by Mito et al method showed, the mean skeletal age in males is 10.8680 with a standard deviation of 2.00595 and the mean skeletal age in females is 13.3320 with a standard deviation of 2.18094 when compared with the mean chronological age in males is 13.3186 with a standard deviation of 1.57073 and the mean chronological age in females is 13.1620 with a standard deviation of 1.66175.

Intraclass correlation coefficient was 0.850 for females which showed excellent agreement (>0.85), for males ICC was 0.297 which showed poor agreement. There was no much significant difference between chronological age and age with Mito et al method in females.

Table 1: Gender wise distribution of Frequency and Percentage

	Frequency	Percent
Female	50	50
Male	50	50
Total	100	100

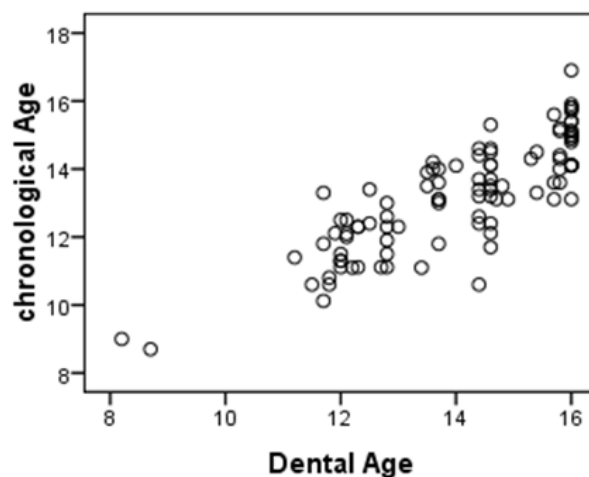


Fig. 2: Comparison of chronological age and dental age (Demirjian's method)

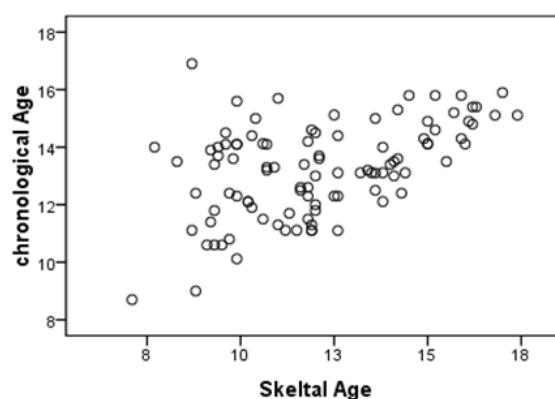


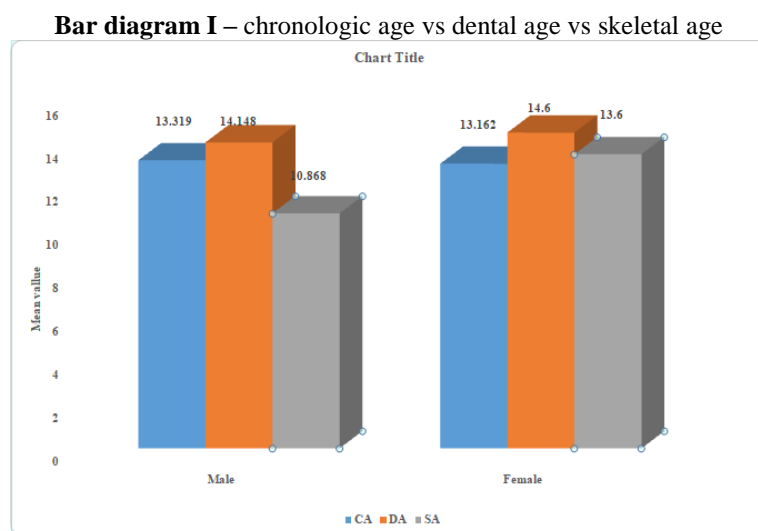
Fig. 3: Comparison of chronological age and skeletal age (Mito et al method)

Table 2: Comparison of chronological age with dental age and skeletal age in males and females

Gender		N	Minimum	Maximum	Mean	Std. Dev.	'P' value
Female	Chronological Age	50	9.0	15.0	13.1620	1.66175	.000
	Age by Demirjian's method (years)	50	8.2	16.0	13.9660	1.67352	.000
	Age by Mito et al method	50	8.8	17.40	13.3320	2.18094	.000
Male	Chronological Age (Years)	50	8.7	15.0	13.3186	1.57073	.000
	Age by Demirjian's method (years)	50	8.7	16.0	14.1480	1.76673	.000
	Age by Mito et al method	50	7.1	15.9	10.8680	2.00595	.037

Table 3 :-Paired t test

	Paired Differences		t	p
	Mean	Std. Deviation		
ca - da	-.817	.962	-8.487	.000
ca - sa	1.140	2.166	5.264	.000
da - sa	1.957	2.155	9.081	.000



IV. Discussion

Radiological method of age estimation is one of the most reliable methods used to calculate the age of an individual. Demirjian's method was introduced by Demirjian A and Goldstien H in 1973 which was updated in 1976 and the method was developed on French Canadian population. It used eight stages of tooth development. This method not only estimates age in years but also in months. In 1999, Demirjian's method has been widely used on British children of Bangladeshi origin and on white Caucasians. Non-significant difference between the ethnic groups was found. In the study done on Dutch population in 2005, Demirjian's method was considered as the most reliable method for age estimation in that population.. There are few studies done on Indian population using Demirjians method. In 1998, a study had applied this method on South Indian population and noticed that there was overestimation in age by three years. With this background another study was conducted in 2011 which used Demirjians eight teeth method and noticed reduction in overestimation by one year in Indian population In our study a good correlation was found between the chronological age and the estimated dental age in both males and females. The intra class correlation for males and females also showed excellent agreement.

Mito et al in 2002 tried to establish a new method for objectively evaluating the skeletal maturation in cephalometric radiographs and derived a regression formula for obtaining cervical vertebral bone age. In the study done by Maria de Paula Caldas in 2007, in Brazilian population to investigate whether skeletal maturation using cephalometric radiographs by Mito et al method is reliable as hand wrist method by Tanner-Whitehouse (TW3) method, concluded that the method can be applied to Brazilian females only. In another study by CMS Krishnaprasad in 2013 done to establish the validity of Mito et als method for evaluating skeletal maturation on cephalometric radiographs, and to compare it with the skeletal age obtained by TW3 method on hand wrist radiographs, concluded that cervical vertebral bone age calculated by this method is as reliable at estimating bone age as is TW3 method on hand wrist radiograph.⁵In a study by Sandeep Kumar in 2016, to evaluate the skeletal maturity by Mito et al objectively and assess the reliability and validity of this method in North Indian subjects, concluded that this method is reliable and can be applied to North Indian females only.

V. Conclusion

The results of our study using Demirjians method showed a good correlation between dental age and chronological age in both males and females. Statistically no significant difference was found between dental age and chronological age in males and females. The Mito et al method was found to be applicable only in females of the study population. So a new method need to be developed for assessing the skeletal age of males using cervical vertebral maturity.

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Shahana P. Sulaiman. "The Efficacy of Demirjian's Method and Mito ET AL Method in Age Estimation – A Comparative Study." IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), vol. 18, no. 7, 2019, pp 41-45.