Dental Age Estimation By Moorrees, Fanning And Hunt Method-A Radiographic Study.

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Abstract

Aim and objectives: The study was aimed at Radiographic evaluation of the dental age by using Moorrees, Fanning and hunt method and to compare it with chronological age of the individual in a study population.

Materials and Methodology: A retrospective, in vitro type of study was carried out to assess the dental age of the patients visiting hospital for various reasons. Panoramic radiographs were obtained from the archives of database that have been taken for various reasons and were examined to fit into inclusion criteria. The sample included 20 males and 20 females. Lower left mandibular seven teeth (incisor to 2nd molar) were taken in consideration and each tooth was then assigned with a score as per Moorrees et al's chart. After every tooth is assigned a reading, a total was made and then the developmental status of a particular Tooth was calculated in years on the basis of charts given by Moorrees et al separately for Boys and Girls.

Results: The study showed that Moorrees, fanning and Hunt (MFH) method significantly underestimates the dental age when compared to Chronological age. It also shows that females achieve formation stages at earlier chronological ages than males. Co-relation(r) between male and female was found to be highly significant, especially in females.

Conclusion: The Moorrees, Fanning and Hunt method underestimates the dental age as compared to chronological age which suggests it is not an accurate method for dental age assessment.

Keywords: Age Determination, MFH, Dental Age, Chronological Age, Panoramic Radiographs.

Introduction

Differences in the development among children of the same chronologic age have led to the concept of

physiologic age as a means to define progress toward completeness of development or maturity in the individual child. The dentition is one of the fourth systems used along with other three developmental indicators that are bone development, secondary sex characters, stature or weight. Dental age can be determined by the emergence and eruption of the teeth[1].

Dental age can be determined by the emergence of teeth through the gingival tissues and also by assessing tooth mineralization by radiographic examination. The assessment of tooth mineralization is a superior method of evaluation compared to tooth emergence for assessing dental maturation for several reason. Dental age information is helpful in the field of dentistry, which can be used to accurately time treatment procedures and help predict eruption sequences in the field of Orthodontics and Paediatric dentistry.[2]

Charts made after population surveys have been used to determine the age of individuals for orthodontic and forensic purposes for many years and have been regarded as sufficiently accurate to estimate chronological age of a juvenile. Standard charts show the bone age, dental age, height and weight, sexual development and secondary growth patterns of kids and juveniles. These charts became the quality references for age assessment used throughout the globe.[3]

The estimation of an individual's age consists of the study of osseous and dental characteristics to have a close approximation of a human being's chronological age. The analysis of these processes is based on the determination and quantification of the events occurring during the growth and development processes[4].

Dental age (DA) is considered a reliable indicator of chronological age (CA), and has been used in dentistry with the aim of determining whether dental maturation of the patient is found to be within average for his age group.[5]

Materials and Methods

A radiographic based retrospective study was carried out in department of Oral Medicine and Radiology Yenepoya Dental College and hospital, Yenepoya university, Mangalore. After obtaining ethical clearance from institution's ethical committee, Orthopantomograph (OPG) were collected from the Department of Oral and Maxillofacial Radiology Database (Archives) that have been taken for various purposes.

The sample size was 40 patients, with 20 females and 20 males, and each OPG (digital) was taken by Planmeca machine under standard protocols and Agfa NX software was used. Radiographs of individuals in age group of 5-16 years, with all complement set of teeth for that age group were included while as faulty images, children below the age of 5 and above the age of 16, and with developmental anomalies and pathologies were excluded from the study. Dental age estimation will be done by directly comparing with the tooth developmental stages on panoramic radiographs with the standards by Moorrees, Fanning and Hunt method.
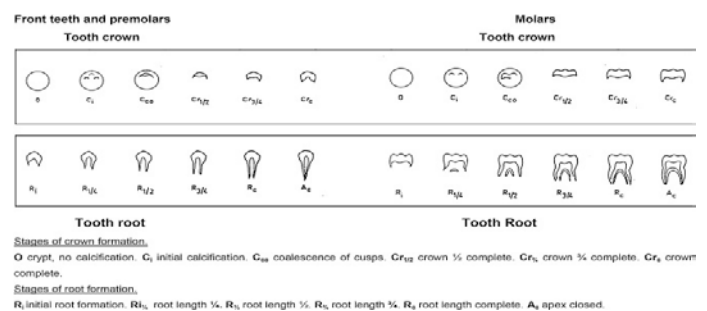

Fig (1) shows stages of tooth formation for assessing the development of single and multi rooted teeth.

Mandible seven teeth (I-M2) were taken into consideration. After noting all stages of teeth from C-M2, the developmental status of a particular Tooth will be calculated in years on the basis of charts given by Moorrees, Fanning and Hunt.
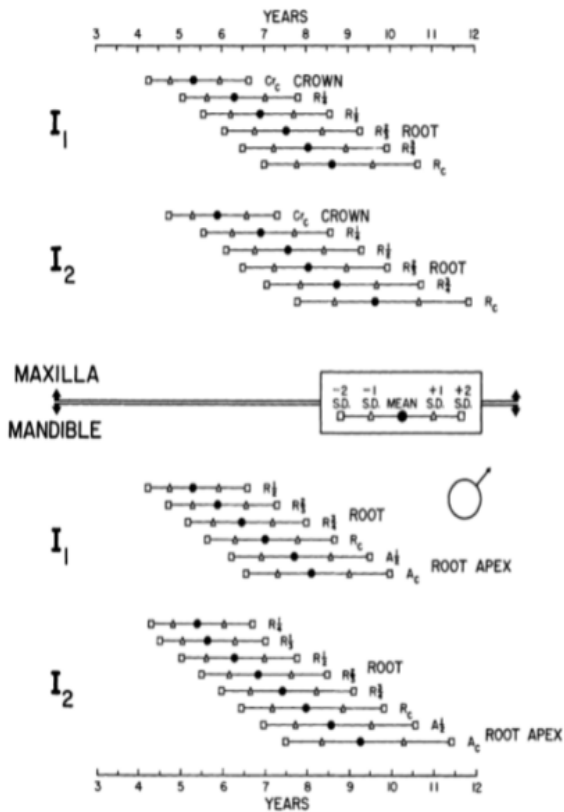
FIG. 3.—Norms of the formation of permanent maxillary and mandibular incisor roots of males, including the crown-complete stage of the maxillary incisors.
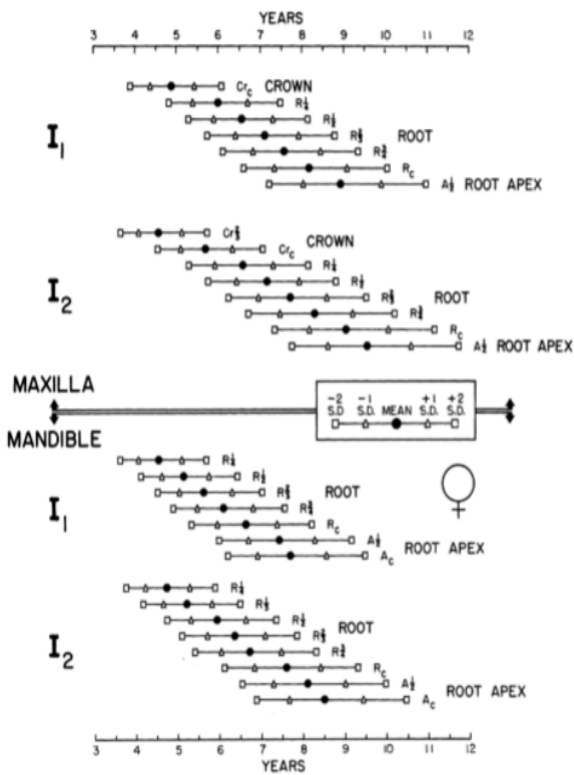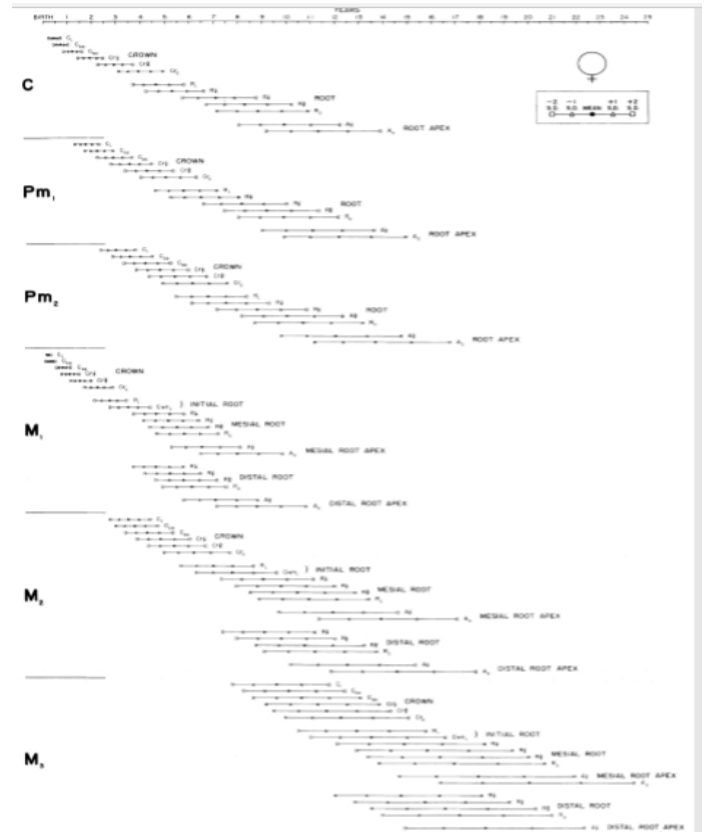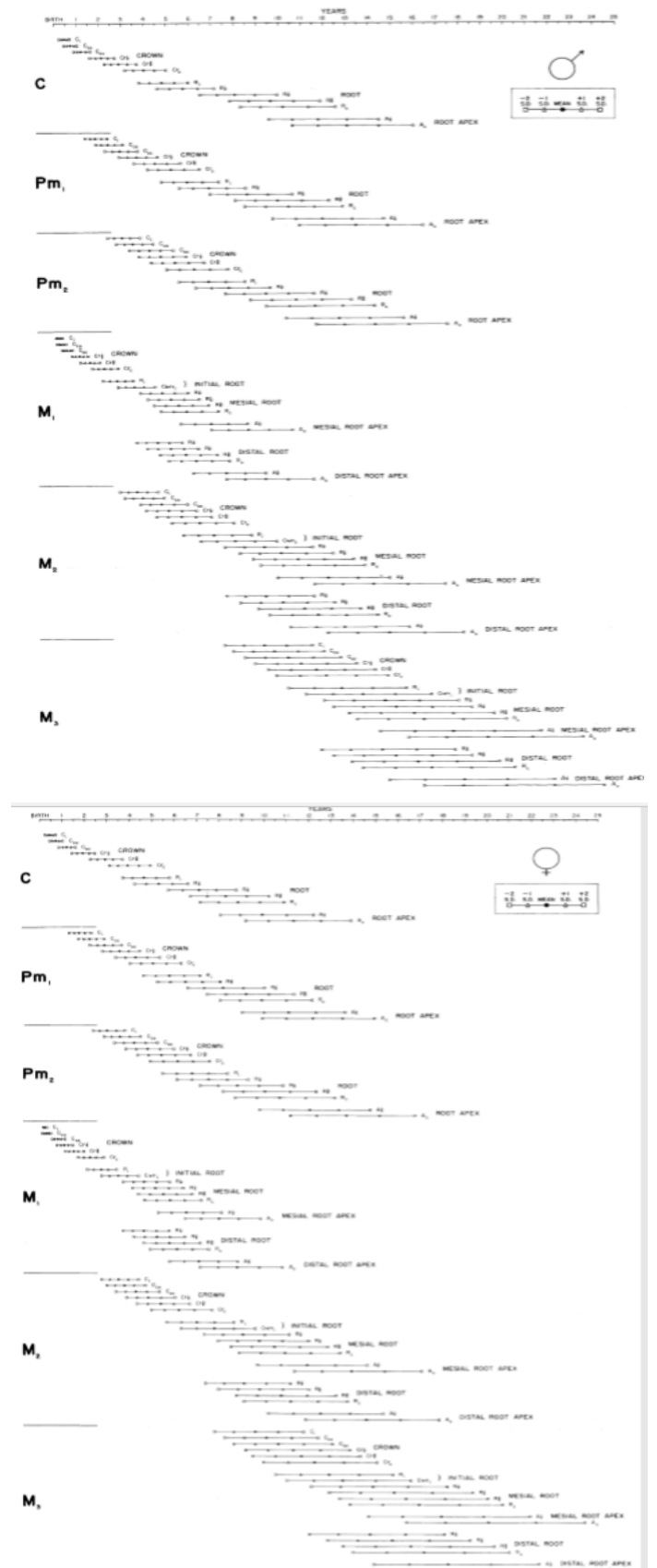
FIG. 4.—Norms of the formation of permanent maxillary and mandibular incisor roots of females, including terminal stages of crown formation of the maxillary incisors.
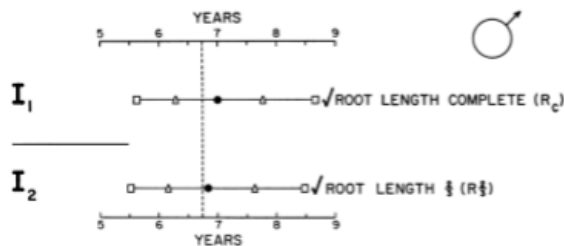
Fig. 8.—The assessment of the formation of the permanent mandibular incisors shown in Figure 7 in terms of the norms shown by reproducing only the relevant section of Figure 3. The attainment of the complete root length (R_C) of the central incisor and two-thirds of the root length ($R_{2/3}$) of the lateral incisor in this 6.75-year-old boy corresponds closely to mean ages of attainment for these stages.
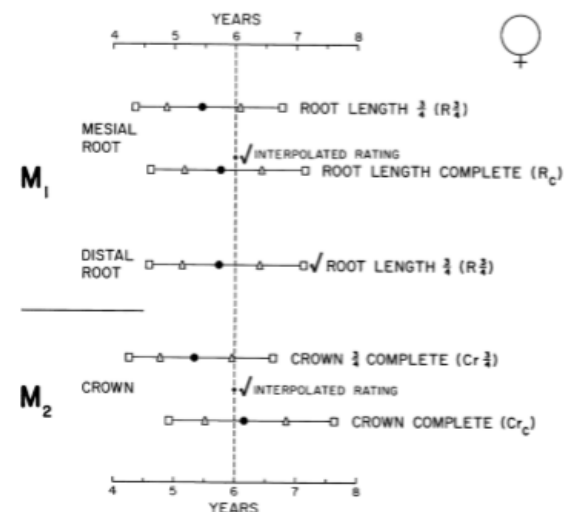

Fig. 9.—Interpolation between stages shown for permanent mandibular first and second molars of a 6-year-old girl, reproducing only the relevant section of Figure 6. The formation of the mesial and distal roots of the first molar and the crown of the second molar corresponds to + 0.6, + 0.4, and + 4 standard scores, respectively, in terms of the norms. The interpolation of the rating for the mesial root of the first molar between $R_{3/4}$ and R_C and of the crown of the second molar between $Cr_{3/4}$ and Cr_C is explained in the text.

These charts by Moorrees at al express tooth formation of an individual child directly in terms of standard scores. These developmental ratings are read for each tooth separately, facilitating comparison of the maturation of different teeth in the same child.

The charts are composed of segments, one for a specific tooth, in which the chronology of its development is recorded graphically by horizontal bars for each stage. On a horizontal bar, the mean age of attainment and the plus and minus one and two standard-deviation limits are indicated by symbols. A scale is provided at the top and bottom of the charts for indicating the age.

The assessment of tooth formation is recorded by a check mark at the appropriate stages for the different teeth. By drawing a vertical line through corresponding points on the age scales, the rating of tooth development of a child is read directly in standard scores at the points of intersection of this vertical line and the horizontal bars for each specific tooth formation stage.

All the values obtained will be summed to obtain an overall maturity score, which will indicate the DA of that particular patient.

For molars, the age for mesial and distal root will be calculated separately, and then mean of both will be taken into consideration.

The CA of each individual is calculated by subtracting the birth date from the date on which the radiographs were exposed for that particular individual.

Results

Student's unpaired t-test was used to carry out the analysis and to determine the co-relation

Table 1: shows mean difference and standard deviation for different variables used in the study.

		N	Mean	Std. Deviation
Pair 1	Age by mfh	40	8.940	2.096
	Ca	40	11.964	2.999

Descriptive analysis shows mean age by MFH to be 8.9 years and mean CA to be 11.9 years which shows that dental age estimation by MFH method significantly underestimates CA.

Table 2: shows mean difference and standard deviation for both male and females.

Gender		N	Mean	Std. Deviation
Male	Age by mfh	20	8.935	2.506
	ca	20	12.002	3.451
Female	Age by mfh	20	8.945	1.654
	ca	20	11.926	2.560

The mean CA for males is 12 years, while in females, it is 11.9 years, which shows that females achieve formation stages at earlier chronological ages than males.

Table 3: shows p value and Correlation(r).

		Ca
Age by MFH	R	.924
	P	.000
	N	40

Table 4: shows p value and Correlation(r) for Males and Females

Gender			ca
Male	Age by MFH	R	.965
		P	.000
		N	20
Female	Age by MFH	R	.845
		p	.000
		N	20

Co-relation(r) between male and female is .924 which is highly significant, especially in females.

Table 5: shows mean, standard deviation, p value by using t-test in males and females.

Gender		Paired Differences		t	P
		Mean	Std. Deviation		
Male	Age by mfh - ca	-3.066	1.226	-11.188	.000
Female	Age by mfh - ca	-2.981	1.460	-9.131	.000

The average estimated (DA-CA) was -3 years for males and -2.9 years for females.

Discussion

The aim of present study was Radiographic evaluation of the dental age by using Moorrees, Fanning and hunt method and to compare it with chronological age of the individual in a study population.

Dental age is the age at which the average child in the reference group exhibits that extent of tooth mineralization. The teeth constitute a very reliable source in age estimation because the enamel is the hardest tissue in the human organism and has a high capacity for preservation even under extreme conditions of PH, humidity, salinity, and high temperatures[3]. Accurate age estimation is a useful part of the identification process for both living and deceased individuals[2].

Moorrees, Fanning and hunt method was introduced in 1963. In this method, Moorrees et al proposes assignation of maturation stages for crown and root, which vary in number according to whether the tooth is single rooted or multi-rooted. Once the stage is selected, Dental age is inferred through graphs which allow knowing the age in which the stage is observed for this particular tooth, this enables calculation through evaluation of a single tooth, or through average of corresponding ages to stages assigned to a group of teeth[5].

The present study compromised of 40 individuals that is 20 male and 20 female, in which dental age was calculated using Moorrees et al method and was compared with CA.

The study shows that dental age estimation by MFH method significantly underestimates CA and also shows that females achieve formation stages at earlier chronological ages than males. The result is in accordance with study carried on American children in 2016 by L.S Tony at al[2].

Philips VM et al in 2009[3] made a study on three South African children samples to estimate the dental age using Moorrees et al and Demirijian, Goldstein and tanner using orthopantomographs. The result of this study showed that the Moorrees method consistently under-estimated the ages of the three samples of South African children.

Martinez Gutierrez VM et al conducted a study on 512 children of Venezuela to estimate the dental age by Moorrees et al, Nolla, Demirjian et al using orthopantomographs and to compare the Dental age With Chronological age. The study concluded by stating that, in general females reached maturation stages at earlier ages than males and also Moorrees et al highly underestimates the dental age. This study is in agreement with the present study.

Coral C et al conducted a study in 2010 on patients of age 5-16 years attending the Dental School at Universidad del Valle. This study evaluated six methods (Logan & Kronfeld; Schour & Massler; Moorrees, Fanning & Hunt; Demirjian, Goldstein & Tanner; Ubelaker & Smith) used in estimating the dental development by using panoramic radiographs. The study showed that the Moorrees et al presented the highest correlation coefficient between dental age and radiographic age with a tendency to overestimating the radiographic age. The result was in discordance with our study.

Conclusion

The study showed that this method underestimates the dental age as compared to chronological age which suggests Moorrees et al method is not an accurate method for dental age assessment.

References

1. Moorrees CF, Fanning EA, Hunt EE. Age variation of formation stages for ten permanent teeth. J Dent Res. 1963 Dec; 42:1490–502.

2. L.S Tony, Maness H, Dayeh A AL, Harris EF. A comparison of two dental age estimation techniques in contemporary American whites. International journal of Forensic science and Pathology 2016 May 20:243-248.

3. Phillips VM, Van Wyk Kotze TJ. Testing standard methods of dental age estimation by Moorrees, Fanning and Hunt and Demirjian, Goldstein and Tanner on three South African children samples . J Forensic Odontostomatol. 2009 Dec 1;27(2):20–8.

4. Corral C, García F, García J, León P, Herrera A, Martínez C, et al. Chronological versus dental age in subjects from 5 to 19 years: a comparative study with forensic implications. Colombia Médica. 2010 Oct 8;41(3):216-223–223.

5. Martinez Gutierrez VM , Ortega-Pertuz AI. Comparison of Nolla , Demirjian and Moorrees methods for dental age calculation for forensic purposes. Revista Odontológica Mexicana. 2017 Jul 1;21(3):151–159.