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ORIGINAL ARTICLE

Estimation of Dental Age by Mandibular Third Molar Through Digital Orthopantomogram Using Modified Demirjian Method In South Indian Population Visiting A Dental College- A Retrospective Study

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Abstract

Aim: The aim of this study was to evaluate the applicability of Demirjian's method for dental age assessment in a group of South Indian population and to develop an age-predictive equation suitable for the studied group.

Subjects and methods: In this retrospective, blind, cross-sectional study, 120 Digital Orthopantomograms were selected from the archived medical files of patients attending Dental College and evaluated to estimate dental age.

Results: Age was over estimated for almost all of the studied subjects with an accuracy range from 0.18 to 1.19 years for males and from 0.08 to 0.87 years for females, with the exception of two age subgroups

Conclusion: Demirjian's method is very useful and suitable for the South Indian population. The development of a prediction equation and the introduction of adaptable conversion tables to transform the maturity score into a dental age for the South Indian population with population-specific samples may be suitable alternatives.

Keywords: Chronological Age, Dental Age, Age Estimation, Demirjian's Method

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INTRODUCTION

When it comes to identifying the living as well as the dead, forensic age assessment is essential. Creating a biological profile is a crucial step before identifying the deceased. Age determination is required in civil and criminal law for living [1]. It is mostly used in cases involving unaccompanied asylum seekers, victims of accidents or conflict, athletes, and in determining criminal responsibility. The eruption and development of teeth follow a predictable pattern that is used to estimate age [1,2]. One of the consistently advised techniques for age assessment is the radiographic observation of tooth development [3]. Third molars develop considerably later and take a very long time to mature, unlike most permanent teeth, which typically reach maturity by the age of 14. This makes it possible to use various phases of the third molar development process as markers of an individual's age [3,4]. Researchers have developed a variety of techniques for estimating age based on the maturation of third molars, and these techniques have been applied in several research. Of them, the Demirjian et al. scoring system has been the subject of much study worldwide. The capacity of third molar maturation graded by Demirjian's approach to determine whether an individual has acquired medicolegally significant age has been more or less confirmed, notwithstanding its utility in estimating the age of young adults[5].

In recent years it has become increasingly important to determine the age of living people for a variety of reasons, including identifying criminal and legal responsibility and for many other social events[6]. Forensic odontology plays an important role in the identification of the age of the human. Teeth and bones are most commonly used for the identification of an unknown individual and for age determination [7]. Dental maturation is a complex sequence of events from initial mineralization of the tooth, crown formation, root formation, the eruption of the tooth into the mouth, and root apex maturation. Among these developing teeth are considered to be the most useful and reliable indicators of maturation [8]. Tooth formation is used for assessing dental maturation because it is a continuous and progressive process that can be followed radiographically and most teeth can be evaluated at each examination [9]. The most widely used method is the assessment of the crown and root formation stage. Radiology plays an indispensable role in human age [10]. The aim of this study is to assess the developmental stages of the mandibular third molar for estimation of dental age in different age groups.

MATERIALS AND METHOD

Chronological age was calculated by subtracting the date of birth from the date, on which the radiographs were taken**.** To avoid bias, the radiographs were numbered from 1-120 and the examiner was blinded to the name, age, and sex of the individuals.120 radiographs of the subjects in the age group of 9-20 years who underwent digital orthopantomogram examination between 2018-2022 in the Department of Oral Medicine and Radiology, Vinayaka Mission's Sankarachariyar Dental College, Salem were retrieved retrospectively and viewed using the DICOM Software- Planmeca Romexis 3.0.0. and the degree of calcification of the mandibular third molar was assessed. The degree of calcification of the tooth was scored according to the modified Demirjian’s method. OPGs showing obvious dental pathology, OPGs without the tooth bud of the third molar, Fractured mandible, Distorted images, and subjects below 9 years of age and above 21 years of age were excluded from the study criteria.

SAMPLE SIZE CALCULATION:

The sample for the study was calculated to be appx 120 orthopantomogram radiographs which were assessed retrospectively

Table 1: Group Distribution

Groups	Age in Years
Group 1	9-12yrs
Group 2	13-16yrs
Group 3	17-20yrs

Table 2: Distribution of the study samples according to their age and gender

Age group	Males	Females
9 – 12 years	20	20
17 – 20 years	20	20
13 – 16 years	20	20
Total	60	60

The Subjects were distributed according to age and gender based on the study groups. In this each age group study samples were segregated accordingly.

RESULT

In this current study, the majority of samples were taken from 9 years to 20 years and equally distributed between both genders to avoid bias. Tests for inter and intra-observer bias did not show any statistically significant variation. The correlation between chronological age and dental age were calculated between both right and left lower third molars of males [Table 2 & 3] and also between the females as well. [Table 4 & 5]

Table 3: Correlation between CA and DA of mandibular left 3rd molar among males

Age group	Mean CA	Mean DA	Mean difference	Correlation r value	P value
9 – 12 years	10.9	11.1	-0.15	0.36	0.11
13 – 16 years	14.05	12.8	1.22	0.53	**0.01**
17 – 20 years	18.33	17.04	1.26	0.52	**0.01**

The table represents the correlation between chronological age and dental age on the left side of the mandible with the mean value of 10.9 and 11.1 at 9-12 years of age and also then mean value of 14 and 12.8 at 13-16 years and then mean value of 18.3 and 17 in 17-20 years of chronological age. The P value is 0.1, 0.05, and 0.01 which is statistically significant in all the age groups.

Table 4: Correlation between CA and DA of mandibular right 3rd molar among males

Age group	Mean CA	Mean DA	Mean difference	Correlation r value	P value
9 – 12 years	10.9	11.3	-0.43	0.22	0.33
13 – 16 years	14.05	12.7	1.35	0.51	**0.01**
17 – 20 years	18.33	17.00	1.33	0.49	**0.02**

The table represents the correlation between the third molar in chronological and dental age among males on the right side of the mandible. The P value represents 0.3, 0.01, and 0.25 which is statistically significant in the age groups between 13-16 years, and 17-20 years.

Table 5: Correlation between CA and DA of mandibular left 3rd molar among females

Age group	Mean CA	Mean DA	Mean difference	Correlation r value	P value
9 – 12 years	10.57	10.48	0.09	0.75	**0.00**
13 – 16 years	14.4	12.85	1.55	0.65	**0.00**
17 – 20 years	18.18	17.02	1.16	0.55	**0.00**

The table represents the mean values of chronological and dental age of females on the left side with the mean difference and correlation with a P value of 0.00 which is statistically significant.

Table 6: Correlation between CA and DA of mandibular right 3rd molar among females

Age group	Mean CA	Mean DA	Mean difference	Correlation r value	P value
9 – 12 years	10.57	10.41	0.16	0.68	**0.00**
13 – 16 years	14.4	13.21	1.19	0.76	**0.00**
17 – 20 years	18.18	16.96	1.22	0.62	**0.00**

The table represents the mean values of CA and DA with the mean difference and correlation between mandibular molar among females. The P values are 0.00 which is statistically significant.

Table 7: Difference in correlation between males and females in left 3rd molar

Age group	Males(r-value)	Females(r-value)	Z value	P value
9 – 12 years	0.366	0.752	-1.67	0.09
13 – 16 years	0.533	0.657	-0.56	0.57
17 – 20 years	0.529	0.553	-0.10	0.91

The table represents the difference in correlation between both males and females in the left mandibular molar in all three groups with the P value of 0.09, 0.57, and 0.91 which is statistically not significant.

Table 8: Difference in correlation between males and females in right 3rd molar

Age group	Males(r-value)	Females(r-value)	Z value	P value
9 – 12 years	0.229	0.681	-1.69	0.09
13 – 16 years	0.518	0.761	-1.23	0.21
17 – 20 years	0.498	0.622	-0.55	0.57

The table represents the difference in correlation between both males and females in the left mandibular molar in all three groups with the P value of 0.09, 0.21 and 0.57 which is statistically not significant.

FIGURE1: Digital OPG showing mandibular right molar and left molar in stage E

FIGURE 2: Digital OPG showing mandibular right and left molar in stage B

DISCUSSION

In this study the chronological age and the dental age were correlated in three age groups. Males and Females were showing a difference between both right and left side, in this right side shows more accuracy than the right side. Left side shows P value of 0.09, 0.57 and 0.91 comparatively, the right side shows 0.09, 0.21 and 0.57 respectively (Table 6,7,8). But the R values vary between male and female right and left side. In the forensic sciences, age estimation is crucial for determining the identity of human remains. Because teeth can last long after other skeleton components have crumbled, dental features alone can frequently provide a solid indication of an individual's age when determining their chronological age[11]. It is rarely recommended to utilize dental radiographs with fully formed teeth for age assessment. Nonetheless, it is a straightforward, non-destructive technique that can be used in identification cases or archaeological research on both live people and the deceased who are unknown[11,12].

Age evaluation is often necessary for forensic and medical odontological purposes, particularly to determine the best moment to begin therapy[13]. As a result, the age should be as precisely calculated as feasible. Globally, DA estimation is widely employed and is believed to have a stronger correlation with CA than other measures of a child's developmental maturity. Numerous techniques based on eruption patterns or calcification (tooth growth) have been proposed for DA estimation[14]. Because tooth emergence can be greatly influenced by local external factors such infection, blockage, crowding, and early excision of the deciduous antecedent or adjacent permanent teeth, relying solely on eruption dates to determine dental asymmetry (DA) becomes more difficult. By understanding radiographic data that represents the stages of tooth development, many accidents can be prevented[15].

Our analysis revealed both the absence of a particular trend and notable variations among the age groups under investigation. As a result, we discovered that Demirjian's initial standards did not correctly estimate the CA in the sample we analyzed, and that applying Demirjian's technique to various populations led to an overall overestimation of the CA by the Estimated Dental Age [15,16]. According to the authors, every group needs a different adaptive dental maturity score. There is growing support for the idea of creating a unique prediction equation for every population.

CONCLUSION

Demirjian’s method is very useful and suitable for the South Indian population. Development of a prediction equation and the introduction of adaptable conversion tables to transform the maturity score into a dental age for South Indian population with population specific samples may be suitable alternatives.

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