

To Evaluate the Efficiency of Demirjian and Cameriere's Methods in Estimating the Age of Children with Mixed Dentition in Kolkata

Bishal Biswas¹, Sanjeet Singh², Paramjit Singh³, Kanika Sharma⁴, Deepti J Singh⁵

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ABSTRACT

Background: As part of the criminal justice system, forensic odontology and forensic dentistry bring dental expertise to bear on cases involving civil and criminal law enforcement. This area of forensic science is both the most exciting and least researched. Contemporary forensic odontology encompasses three crucial domains. Injury to the jaws, oral tissues, and teeth from any source must first be evaluated and examined. The second reason is that we want to look at the markings in the hope of identifying or eliminating a suspect as the predator. Thirdly, identifying dental artifacts may require analyzing either partial or whole dentition, which includes all forms of dental restoration.

Aim: To determine the best method for age estimation among (Demirjian and Cameriere's) for age estimation in children of mixed dentition.

Methodology: Participants' ages ranged from 6 to 15 years, and they were chosen at random for the study. Prior to the investigative technique, informed consent was acquired. The study utilized orthopantomographs, which were analyzed using the GIMP 2.10 tool. Using orthopantomographs, Demirjian's approach, and Cameriere's method, the dental age was ascertained.

Results: The mean difference from the actual age was higher in the Demirjian method as compared to the Cameriere method. This shows the Cameriere method to be better as compared to Demirjian method.

Conclusion: The level of accuracy achieved by the Cameriere's method is more than that achieved by the Demirjian method.

Keywords: Cameriere, Demirjian, Forensic dentistry.

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INTRODUCTION

Determining a child's dental age (DA) is significant since it provides a way to estimate their CA when their birth date is unavailable. Teeth, particularly those of a person's first and second set of molars, are among the most accurate indicators of age. Assessing the victim's growth stages is one of the most trustworthy methods to ascertain their age.¹

When it comes to estimating a person's age from their teeth, Demirjian's approach is by far the most widely utilized and respected internationally. Using this technique, Demirjian first studied French-Canadian children and assessed the radiographs of seven permanent left mandibular tooth buds. Multiple international evaluations of Demirjian's age estimate technique have produced conflicting conclusions about its validity and reliability.² Age estimate using Cameriere's approach is also possible; this method takes into account the link between open-apex teeth and age in European populations. However, panoramic radiography is often sought for orthodontic treatment and other dental operations.³ Demirjian et al. stated that panoramic radiographs may be used to evaluate the different phases of tooth calcification and, therefore, to ascertain the dental age.⁴

AIM

To determine the best method for age estimation among (Demirjian and Cameriere's) for age estimation in children of mixed dentition.

¹⁻⁴Department of Oral Pathology, DJ College of Dental Sciences and Research, Modinagar, Uttar Pradesh, India

⁵Department of Pediatrics and Preventive Dentistry, DJ College of Dental Sciences and Research, Modinagar, Uttar Pradesh, India

Corresponding Author: Bishal Biswas, Department of Oral Pathology, DJ College of Dental Sciences and Research, Modinagar, Uttar Pradesh, India, Phone: +91 8791358868, e-mail: 18021997bb@gmail.com

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METHODOLOGY

Participants' ages ranged from 6 to 15 years, and they were chosen at random for the study. Prior to the investigative technique, informed consent was acquired. For this investigation, orthopantomographs were acquired and analyzed using the GIMP 2.10 program. Fifty participants, evenly distributed across sexes, with ages between 6 and 15 years made up the study's sample. Every one of the 50 participants underwent a thorough physical examination, during which we noted their names, sexes, birthdates, and radiograph dates. The CA of a person was determined by subtracting their birthdate from the date of radiograph exposure for that specific

person. Using orthopantomographs, Demirjian's approach, and Cameriere's method, the dental age was ascertained.⁵

Dental Age Assessment

The study's participants' ages ranged from 6 to 15 years. The investigatory process was preceded by the acquisition of informed consent. The research used orthopantomographs, which were analyzed using the GIMP 2.10 tool. For the study, 50 volunteers—female and male—between the ages of 6 and 15 years were picked at random. Each of the 50 volunteers had a comprehensive medical examination, during which we recorded their names, sexes, birthdates, and radiograph dates. A person's CA was calculated by subtracting their birthdate from the date of radiograph exposure for that specific person. Using orthopantomographs, Demirjian's approach, and Cameriere's method, the dental age was ascertained.⁶

Demirjian's Method

Using Demirjian's technique, the evaluation of dental age was finalized. The author rated all panoramic radiographs according to the criteria laid out by Demirjian et al., without knowing the actual age of the patient. With the exception of the third molar, all seven of the other teeth on the jaw were scored. The degree of calcification in each tooth was assessed using an eight-stage scale, ranging from A to H. After tallying up the results from all seven dentition phases, we were able to calculate the subject's dental maturity.⁷

The chronological age was determined by subtracting the birthdate from the date of panoramic radiograph. According to Demirjian's stages of development, each of the seven teeth on the left side of the jaw was given a stage and a self-weighted score. Using these numbers, the maturity scores were then computed. From the maturation score, a dental age was calculated using the conversion tables provided by Demirjian.⁸

Cameriere's Method

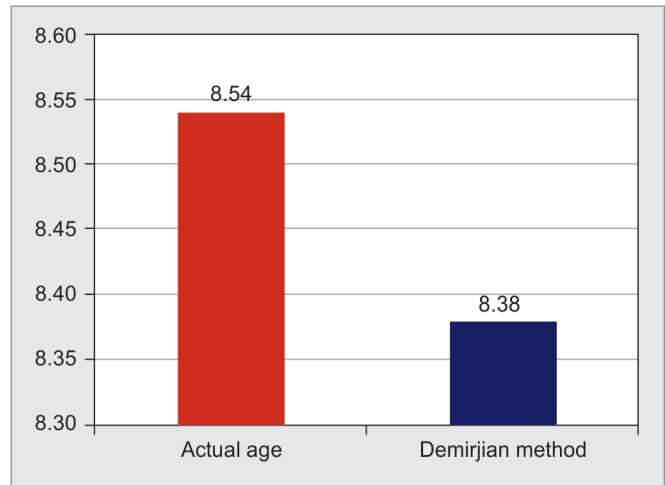
"The approach used by Cameriere et al. was used to get the DA estimate. We counted the teeth that had entirely closed apical ends (N0), which means that their roots were fully grown. On teeth with fully developed roots and open apices, the measurement was taken of the distance (A_i , $i = 1, \dots, 5$) between the inner side of the open apex. A_i , where $i = 6, 7$, is the sum of the lengths measured between the inner surfaces of the two open apices of two-rooted teeth. To standardize the data and minimize the effect of variances in X-ray magnification and angulation, measurements were divided by the tooth length (L_i , $i = 1, \dots, 7$). To evaluate dental maturity, we employed the following metrics: the sum of the normalized open apices (s), the number of teeth (N0) with complete root development, and the normalized measurements of the seven left permanent developing mandibular teeth ($x_i = A_i/L_i$, $i = 1, \dots, 7$). The following formula was used to calculate DA."

"Age = $8.387 + 0.282g - 1.692 \times 5 + 0.835 N0 - 0.116s - 0.139s * N0$ where g is a variable, with $g = 1$ for boys, and $g = 0$ for girls."⁹

RESULTS

Comparison of Actual Age with Demirjian Method¹⁰

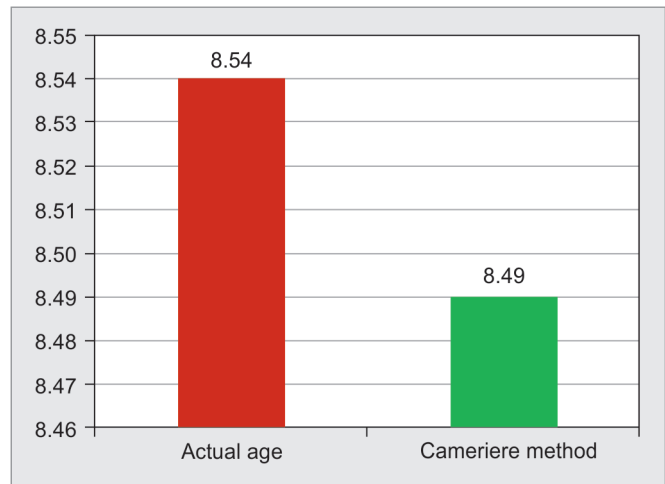
	Mean	Std. deviation	Std. error mean	Mean difference	p-value
Actual age	8.54	2.65	0.375	0.160	0.002 (Sig)
Demirjian method	8.38	2.68	0.379		



Using the Demirjian method, the participants' estimated ages were 8.38 (SD = 2.68) years old, whereas their mean real ages were 8.54 (SD = 2.65) years old. The average discrepancy between the real and predicted ages was 0.160. Using the paired *t*-test, we found a statistically significant difference between the actual and projected ages.¹⁰

Comparison of Actual Age with Cameriere Method¹¹

	Mean	N	Std. deviation	Std. error mean	Mean difference	p-value
Actual age	8.54	50	2.65	0.375	0.048	0.247
Cameriere method	8.49	50	2.64	0.378		



Using the Cameriere method, the individuals' estimated ages were 8.49 (SD = 2.64) years old, whereas their mean real ages were 8.54 (SD = 2.65) years old. The average discrepancy between the real and predicted ages was 0.048. Using the paired *t*-test, we found no statistically significant difference between the actual and projected ages.¹¹

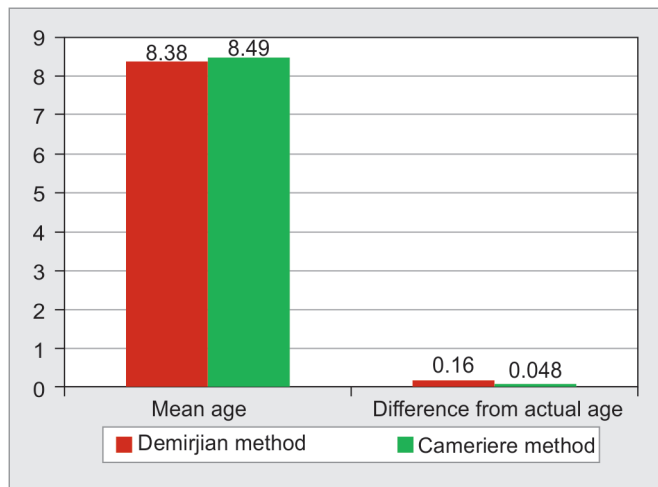
ERRORS IN AGE ESTIMATION

The mean error in the age estimation was 0.160 ± 0.543 in the Demirjian method and 0.048 ± 0.307 in the Cameriere method.

The overall error in the age estimation was 0.104 ± 0.391 . The number of samples with error in the age estimation was 62% in the Demirjian method and 30% in the Cameriere method.¹²

Comparison of Demirjian Method with Cameriere Method¹³

	Mean	N	Std. deviation	Std. error mean	Mean difference from the actual age	p-value
Demirjian method	8.38	50	2.68	0.379	0.160	0.001 (Sig)
Cameriere method	8.49	50	2.64	0.378	0.048	



Both the Demirjian and Cameriere methods yielded similar results for estimating ages; 8.38 and 8.49, respectively, with a standard deviation of 2.68 and 2.64. The Cameriere method had a mean discrepancy of 0.048 years from the real age and the Demirjian method of 0.160 years. The difference between the two groups was statistically significant. The mean difference from the actual age was higher in the Demirjian method as compared to the Cameriere method. This shows the Cameriere method to be better as compared to Demirjian method.¹³

DISCUSSION

This study's sample showed an average age of 8.248 years, a standard deviation of 2.62382, and a mean difference of 0.140 when analyzed using the Demirjian method.

This study found that between expected DA and CA, there was a 0.062-year gender gap and a 0.143-year men's gap. No statistically significant difference was found between the sexes in this entire sample. Although DA and CA are statistically similar on average, there is a noticeable gender gap when it comes to maturity.¹⁴

For both sexes, the Demirjian approach to calculate predicted dental age appears to have underestimated chronological age. The difference between the sexes was more apparent in the former. Comparisons were made between the chronological age, the "gold standard," and the estimated age derived from the Demirjian approach.¹⁵ To illustrate the disparity, the average age gap was utilized. Finding the mean difference between an individual's estimated dental age and their actual age in decimal years is the

way to proceed. The correlation coefficient, or any other alternative, would provide too much uncertainty as an accuracy metric.¹⁶

In contrast, the research participants' mean real ages were 8.54 and 8.49, respectively, when applying the Cameriere method. Compared to the results obtained using the Demirjian approach, the average discrepancy between the real and calculated ages was 0.048.¹⁷

In males, the mean difference was 0.250 by the Demirjian method, whereas in the Cameriere method, the mean difference was 0.110, which validates the Cameriere's method to be more correct in the male population.¹⁸

When we consider the female group, it shows a mean difference of 0.070 by the Demirjian method and 0.012 by the Cameriere's method, further validating the correctness of the Cameriere's method over the Demirjian method.¹⁹

The mean error in the Demirjian method was 0.160, i.e., 62%, whereas the mean error in the Cameriere method was just 0.048, i.e., 30%, which further validates its correctness. The level of accuracy achieved via the Demirjian method was 38%, whereas the level of accuracy achieved via the Cameriere method was 70%.²⁰

Consequently, when it came to estimating females' ages, Cameriere's technique outperformed Demirjian's technique. When it came to determining the ages of males, however, Cameriere's approach performed better than Demirjian's approach, underestimating the men's ages by 0.93 and 0.04 years, respectively.²¹

Tunc and Koyuturk²² found that, contrary to the age estimated using Demirjian's method, the chronological age of males in Turkey was 0.36–1.43 years and that of females was 0.5–1.44 years younger. This finding is in agreement with the majority of previous research (19–21). Their findings demonstrated that Demirjian's technique was superior to the others. Consistent with Prabhakar and Panda, who used Demirjian's method, the new data show that Indian men are 1.2 years younger than projected and that Indian ladies are 0.9 years younger.²³

Hegde and Sood in their study of Belgian children from the ages of 6–13 found that Demirjian's method was discovered to exaggerate the chronological age of boys by 0.14 years and girls by 0.04 years. There were fewer discrepancies between the two datasets than in the current study.²⁴

The conflicting results of the study might be attributed to racial differences and the larger age range of Belgian youngsters. Chaillet et al. found that Demirjian's method artificially inflated the ages of boys and girls between the ages of 6 and 15, much as the present results. Lee et al. looked at 1,483 Korean children from the ages of 3–16 and discovered that the age estimations produced by Demirjian's approach were off by 0.28 and 0.33 years, respectively.²⁵ Although they reached the same conclusions as us, the gap between their estimated and actual ages was smaller than ours. One possible explanation is that the two studies were biased due to differences in sample size, race, or the age range of the children studied.²⁶

In line with the present results, Altan et al.²⁷ studied Turkish children aged between 4 and 15.99 years and discovered that Demirjian's approach caused females' ages to be 0.832 years and boys' ages to be 0.923 years inflated. Galić et al.²⁸ in their study of Bosnian and Herzegovinian children from the ages of 6–13 found that the Cameriere method overvalued the ages of females by 0.09 years and underestimated the ages of boys by 0.02 years. Perhaps because of ethnic differences and differences in the age range of children, their results differed from the current findings acquired utilizing Cameriere's technique. Results in boys are in line with the

current findings; however, in girls the study by Fernandes et al.²⁹ using Cameriere's approach to investigate Brazilian children aged between 5 and 15 years differs from the current study. This method, they found out, was underestimating the kids' ages. Possible explanations for the discrepancies in findings include disparities in the ages of the children included in the two studies and racial inequality. Apaydin and Yasar found that the age was underestimated by 0.58% using the Cameriere technique and by 0.342 years utilizing the Demirjian approach when they examined the panoramic radiographs of 330 Turkish children ranging in age from 5 and a 1/2 to 15 and a 1/2 years.³⁰ Their results for females were consistent with the current findings. Depending on the strategy used, Cameriere's approaches were more accurate than Demirjian's for boys. This contradicts what they said regarding the reduced error rate of Demirjian's approach. Possible causes of discrepancies in the findings include variances in the age range and sample size of the children, disparities in ethnicity that may cause distinct patterns of development, and other factors.³¹

CONCLUSION

Half of the participants were male and half were female, and their ages ranged from 6 to 15 years. To calculate the patient's dental age, we took their birthdate and subtracted it from the date of the radiograph exposure. The chance to compare the two methods allowed us to assess how well they linked dental age to chronological age. The dental age was determined using orthopantomographs, which utilized the Demirjian and Cameriere's techniques. We looked at the numbers. There were statistically significant connections in this research between the Demirjian and Cameriere's techniques to calculate DA and CA. The Cameriere's technique is more accurate than the Demirjian method, even though both appear to be appropriate to calculate the ages of both sexes.

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