Assessment of the coming of age using the Caggiano method based on Demirijian stages and the Cameriere method applied to third molars in a Brazilian population

Mirela Cristina da Silva[1], Isabela dos Santos Moreira[1], Victor Jacometti[1], Laís Valencise Magri[2], Ricardo Henrique Alves da Silva[3]

[1] Department of Pathology and Legal Medicine, Ribeirão Preto Medical School, USP - University of São Paulo. Ribeirão Preto, Brazil. [2] Department of Restorative Dentistry, Ribeirão Preto School of Dentistry, USP - University of São Paulo. Ribeirão Preto, Brazil. [3] Department of Stomatology, Public Health and Forensic Odontology, Ribeirão Preto School of Dentistry, USP - University of São Paulo. Ribeirão Preto, Brazil

Corresponding author:
ricardohenrique@usp.br

The authors declare that they have no conflict of interest.

KEYWORDS

Dental Age Estimation, Forensic Odontology, Criminal Liability, Third Molar

J Forensic Odontostomatol 2026. Apr; (44): 1 -17:24
ISSN :2219-6749
DOI: doi.org/10.5281/zenodo.19689686

ABSTRACT

Age estimation can be carried out through dental methods to determine whether an individual has attained legal majority. The aim of the study was to apply the methods proposed by Caggiano et al. (2022) based on Demirjian et al. (1973) stages and Cameriere et al. (2008), to third molars to estimate the legal age of 18 years, through the evaluation of panoramic radiographs in a Brazilian sample. The final sample of this study comprised 270 radiographs, including 188 from females and 82 from males, belonging to individuals aged between 16.00 and 23.99 years. After data collection, the information was organized in Microsoft Excel© spreadsheets and subjected to descriptive statistical analysis. The method proposed by Caggiano et al. (2022) method based on Demirjian et al. (1973) stages, proved to be more sensitive than specific. In contrast, the method proposed by Cameriere et al. (2008) showed the opposite pattern, demonstrating greater specificity than sensitivity. It can be concluded that the results showed moderate accuracy for both methods.

INTRODUCTION

A person's age is directly related to their civil rights and responsibilities.[1] In Brazil, majority is reached upon turning 18 years of age.[2] From that age onward, individuals are eligible to obtain a driver's license, buy and sell property, get married, as well as being legally required to vote.[2] In the criminal context, the age of majority is established at the same age.[3] Therefore, estimating an individual's age is essential to ensure that penal laws and penalties are properly applied to the offender.[3]

In Dentistry, age estimation can be carried out using methods that assess the development and mineralization stages of the third molars.[4-6] The analysis of these teeth is important because, at the end of adolescence, dental development is finished except for these teeth, and that serve as the sole dental age indicator during the transition from adolescence to adulthood.[7]

In the study by Cameriere et al. (2008),[6] the third molar maturity index (I_{3M}) was created, defined as the ratio of the sum of the root apex openings to the total tooth length.[6] If by chance the root development is complete, the numerator is zero. Furthermore, the authors established a cutoff value of 0.08. Thus, a value less than or equal to 0.08 indicates that the individual is 18 years of age or older, whereas a value above this threshold suggests otherwise.[6]

On the other hand, the method proposed by Demirjian et al. (1973)[8] outlined eight stages of dental development. In this method, the seven permanent left mandibular teeth are considered, except for the third molar.[8] The stages are classified using letters (A to H) and range from crown formation to root apex closure.[8] The assessment was performed based on the scores proposed by the TW2[9] method, comparing dental age with skeletal age. Although third molars were excluded from the original study by Demirjian et al. (1973),[8] subsequent studies have used solely these teeth, in combination with the authors' development stages, to determine the attainment of 18 years of age.[7,10] Accordingly, Caggiano et al. (2022)[10] modified the method proposed by Demirjian et al. (1973),[8] establishing that, in the classification of the four third molars, an individual was considered to have reached legal age even when a lower third molar at stage G was associated with an upper third molar at stage H.

The methods proposed by Cameriere et al. (2008)[6] and Demirjian et al. (1973)[8] have been widely tested in different populations.[1,11-13] However, it is still necessary to compare their applicability, given the importance of third molars for estimating civil and criminal majority. Considering the scarcity of studies conducted in the Brazilian population, particularly those addressing adaptations of the method proposed by Demirjian et al. (1973),[8] further research is warranted to assess its applicability in this context. The aim of this study was to apply the methods proposed by Caggiano et al. (2022)[10] based on Demirjian et al. (1973)[8] stages and Cameriere et al. (2008)[6], to third molars in order to estimate the legal age of 18 years, through the evaluation of orthopantomograms (OPGs) in a Brazilian sample.

MATERIALS AND METHODS

This project was submitted to and approved by the Research Ethics Committee of the University of Ribeirão Preto, under CAAE number 45480721,3,0000,5498. This is a cross-sectional study that used a sample obtained from the dental records, in which OPGs of individuals with known age and sex were obtained and analyzed.

The OPGs were obtained from individuals who underwent dental treatment. For the image acquisition, the individual was positioned with an upright spine, feet together, and chin resting on the chin support of the Veraviewepocs 2D© radiographic device (J. Morita Corp., Osaka, Japan). The anterior teeth were positioned in the incisal guide (standard/disoccluded panoramic position), with the head secured between the device's head supports, while the tongue was kept pressed against the palate. The device was adjusted so that the Frankfurt plane was parallel to the ground.

Initially, 951 OPGs from both sexes, with ages ranging from 16.00 to 23.99 years were obtained. The inclusion criteria comprised radiographic examinations of good quality, with minimal distortion, adequate sharpness, appropriate contrast and density, allowing proper visualization of all four third molars for the accurate assessment of their development and mineralization stages. The exclusion criteria were examinations showing impacted or extracted third molars, anomalies, agenesis, endodontic treatments, pathological processes such as odontogenic tumors, extensive carious lesions, and metallic devices that could impair tooth visualization.

After applying these criteria, the final sample reduced to 270 radiographs, 188 from females and 82 from males. Then, the samples were randomized and renamed so that the examiners were blinded to the individuals' information, avoiding cognitive bias in the analysis. ImageJ® software (National Institutes of Health, Bethesda, Maryland, USA) was used in a low-light environment for image analysis.

For the method proposed by Cameriere et al. (2008),[6] a measurement was taken of the width between the internal walls of open apexes, and another measurement of the total tooth length. The first measurement of the internal width of the apices was related to the development process, understood as the sum of the measurements of each open apex or the measurement of a single apex (Fig. 1). The index was calculated as the ratio between the width measurements and the total tooth length, with a cutoff value of 0.08 (Fig. 1). The results were then put in a spreadsheet: values greater than or equal to 0.08 indicated individuals younger than 18 years, and greater values assigned individuals otherwise (18 years old or older).

The same classification system developed by the authors was used For the method proposed by Demirjian et al. (1973),[8] (Fig. 2). However, to

determine the legal age of 18 years, the Caggiano et al. (2022)[10] method was used, which considers all four third molars present in an individual's dental arches. The legal age was assigned to the subject based on the presence of a mandibular third molar in stage G and a maxillary third molar in stage H.[10] The results were coded in the same manner as for the Cameriere et al. (2008)[6] method.

Statistical Analysis

The samples were independently analyzed by two examiners for both methodologies. The data collected were organized in Microsoft Excel© spreadsheets (Microsoft Corp., Redmond, WA, USA) and subjected to descriptive statistical analysis using the same software.

To assess the intra- and inter-examiner reliability, the intraclass correlation coefficient (ICC) was calculated for the Cameriere et al. (2008)[6] method. For the Caggiano et al. (2022)[10] method based on Demirjian et al. (1973)[8] stages, Cohen's Kappa coefficient was used. Agreement analyses were performed on 10% of the total sample (n = 27), with a fifteen-day interval between evaluations.

After the sample analysis, a confusion matrix was constructed to assess the metrics of the methods to distinguish whether individuals were above or below 18 years of age. The accuracy, sensitivity, and specificity were then calculated for each method.

Figure 1. Representation of the application of the Cameriere et al. (2008)[6] method in the sample.

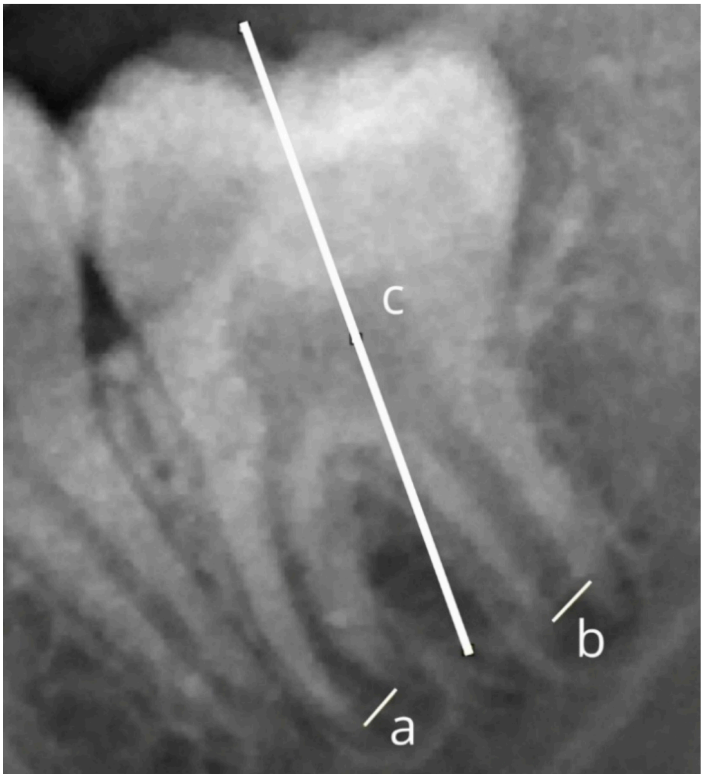
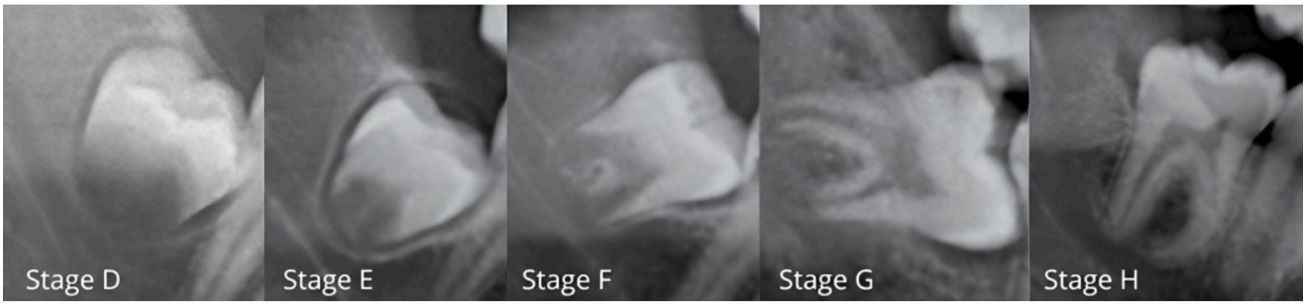


Figure 2. Application of selected Demirjian et al. (1973)[8] stages according to the approach of Caggiano et al. (2022)[10] in the sample.



RESULTS

A total of 270 radiographic examinations were analyzed. Table 1 shows the distribution of the sample according to sex and age group.

For the Cameriere et al. (2008)[6] method, an ICC of 0.95 was obtained for intra-examiner agreement, considered excellent, and 0.76 for inter-examiner agreement, indicating good reliability.[16] For Caggiano et al. (2022)[10] method based on Demirjian et al. (1973)[8] stages, Cohen's Kappa coefficient was calculated for each analyzed tooth. For intra-examiner reliability, the values obtained for the upper third molars were considered substantial (0.65 and 0.66), while for the lower third molars they were considered almost perfect (0.87 and 0.93)[17] (Table 2). On the other hand, the inter-examiner coefficients were considered moderate for the upper left third molar (0.49) and the lower right third molar (0.55), while for the upper right third molar and lower left third molar they were considered substantial (0.65 for both)[17] (Table 3).

The data were organized using confusion matrices for the Cameriere et al. (2008)[6] method (Table 4) and the Caggiano et al. (2022)[10] method based on Demirjian et al. (1973)[8] stages (Table 5). Thus, the Cameriere et al. (2008)[6] method obtained an accuracy of 0.52, a sensitivity of 0.37, and a specificity of 0.78 in the total sample (Table 6). For the Caggiano et al. (2022)[10] method, the total sample obtained an accuracy of 0.65, a sensitivity of 0.76, and a specificity of 0.46 (Table 6).

Table 1. Descriptive statistics of the total sample grouped by sex and age.

Age groups (Years)	Female	Male	Total
16.00 – 16.99	25	12	37
17.00 – 17.99	41	18	59
18.00 – 18.99	25	28	53
19.00 – 19.99	26	6	32
20.00 – 20.99	29	5	34
21.00 – 21.99	19	4	23
22.00 – 22.99	14	4	18
23.00 – 23.99	9	5	14
Total	188	82	270

Table 2. Intra-examiner agreement coefficients obtained using Cohen's Kappa for the Caggiano et al. (2022)[10] method based on Demirjian et al. (1973)[8] stages.

Tooth	Cohen's Kappa Coefficient
18 (upper right third molar)	0.65
28 (upper left third molar)	0,66
38 (lower left third molar)	0.87
48 (lower right third molar)	0,93

Table 3. Inter-examiner agreement coefficients obtained using Cohen's Kappa for the Caggiano et al. (2022)[10] method based on Demirjian et al. (1973)[8] stages.

Tooth	Cohen's Kappa Coefficient
18 (upper right third molar)	0.65
28 (upper left third molar)	0,49
38 (lower left third molar)	0.65
48 (lower right third molar)	0,55

Table 4. Confusion matrix evaluating the ability of the Cameriere et al. (2008)[6] method to distinguish individuals according to the legal age of 18 years.

		Real Age	
		>18 years	<18 years
Estimated Age	>18 years	66	21
	<18 years	108	75

Table 5. Confusion matrix evaluating the ability of the Caggiano et al. (2022)[10] method based on Demirjian et al. (1973)[8] stages to distinguish individuals according to the legal age of 18 years.

		Real Age	
		>18 years	>18 years
Estimated Age	>18 years	133	51
	<18 years	41	45

Table 6. Presentation of the likelihood ratio (LR+), negative predictive value (VP-), positive predictive value (VP+), accuracy (Acc), sensitivity (Sens), and specificity (Spec) for both the Cameriere et al. (2008)[6] and Demirjian et al. (1973)[8] methods.

Method	LR+	VP-	VP+	Acc	Sens	Spec
Cameriere et al.[6] (2008)	1.73	0.4	0.75	0.52	0.37	0.78
Caggiano et al. (2022)[10]	1.43	0.52	0.72	0.65	0.76	0.46

DISCUSSION

The stage classification developed by Demirjian et al. (1973)[8] can be applied to third molars for assessing the legal adulhood.[18] Mincer et al. (1993)[7] demonstrated that the development of upper third molars occurs slightly earlier than that of the lower ones. Conversely, Zandi et al. (2014)[19] found no significant difference in the development of these teeth. In the present study, the application of the Caggiano et al. (2022)[10] method revealed a higher concentration of stage H classifications in the upper third molars compared with the lower ones. Similarly, Gaêta-Araujo et al. (2021)[20] reported that, when the method proposed by Demirjian et al. (1973)[8] was applied to a Brazilian sample, the mean ages corresponding to each stage showed no significant differences between the upper and lower arches. Pinheiro et al. (2023)[21] also observed approximately a 90% agreement between the developmental stages of maxillary and mandibular third molars in the Brazilian population.

In the present study, the Cameriere et al. (2008)[6] method showed excellent intra-examiner agreement and good inter-examiner agreement.[16] These values were not substantially different compared to the study by Sartori et al. (2024),[1] who applied the method to a sample from the southern Brazilian population, obtaining an ICC of 0.92 for intra-examiner and 0.85 for inter-examiner reliability.

On the other hand, for the Caggiano et al. (2022)[10] method based on the Demirjian et al. (1973)[8] stages, intra-examiner agreement was considered substantial for the upper third molars and almost perfect for the lower third molars.[17] Meanwhile, for inter-examiner reliability, the agreement values ranged from moderate to substantial.[17] These values were lower than those reported in other studies. In the study by Caggiano et al. (2022),[10] values of $\kappa = 0.86$ and weighted $\kappa = 0.76$ were obtained for intra- and inter-examiner evaluations, respectively. For Marrero-Ramos et al. (2020),[22] who considered only the "D" and "H" development stages of the Demirjian et al. (1973)[8] method, a weighted Kappa index of 0.78 was reported.

The fact that the inter-examiner agreement ranged from low to moderate for the stages of the Caggiano et al. (2022)[10] method based on Demirjian et al. (1973)[8] stages, did not necessarily imply disagreement regarding the determination of legal adulthood. This is because, overall, the outcome was consistent between the evaluators;

that is, both reached the same conclusion when classifying the individual as either above or below 18 years of age. In such cases, the legal threshold (i.e., whether the age of criminal responsibility has been reached) holds greater relevance for judicial authorities than the variation in the stages assigned by each examiner.

The discrepancies observed among the reported values in different studies may be attributed to variations in the age range of the samples, as younger individuals (9 to 21 years old) allow for a more accurate assessment of third molar developmental stages.[10] In addition, factors such as agenesis, impaction, and the timing of third molar eruption can reduce the reliability of the analysis of this dental element.[10] Furthermore, the morphology of third molar roots may limit visualization, thus requiring greater examiner experience.[23-25] Moreover, biogeographical differences and sample size can directly influence the results, as pointed out by Shi et al. (2024).[26]

After applying the methodologies, it was observed in the present study that using the Demirjian et al. (1973)[8] method in combination with the analysis by Caggiano et al. (2022)[10] for third molars, the total sample showed higher sensitivity than specificity, with respective values of 0.76 and 0.46. Thus, when considering legal adulthood, the method better identifies individuals who are over 18 years of age. The same was observed in the original study by Caggiano et al. (2022),[10] although with a higher sensitivity value of 96.7%.

In the present study, an accuracy of 0.65 was found, whereas Caggiano et al. (2022)[10] reported an accuracy of 90.2%. In the study by Upalananda et al. (2025),[12] although a different methodological approach was used, a similar accuracy of approximately 0.60 was observed for stage H in both sexes and on both the right and left sides.

In contrast, for the Cameriere et al. (2008)[6] method, this study found a specificity of 0.78 in the total sample, indicating a good performance in estimating individuals under 18 years of age. Given that the method is more specific than sensitive, this value was similar to that reported by Sartori et al. (2024),[1] which was 0.84. However, when comparing the specificity results with the study by Cameriere et al. (2008),[6] the value in the original study was higher, at 0.95 although the same condition was observed,. In the forensic context, this means that the method is more reliable for underestimating the individual, which is important considering the civil and criminal implications for an adult individual.[27]

Overall, when analyzing the results obtained in the present study, it can be observed that for both methods the performance was lower than that reported in previous studies in the scientific literature.[10,28-30] This may have occurred due to the need to select all four third molars in the radiographic examination in order to standardize the sample for both methods analyzed. However, it is important to note that the maxillary third molars were used only for the assessment of the Caggiano et al. (2022)[10] method based on the Demirjian et al. (1973)[8] stages.

However, third molars are subject to agenesis, which is related to a human evolutionary processes involving changes in dietary habits and a reduction in jaw size, resulting in decreased functionality of these teeth.[31-33] Moreover, third molars are commonly extracted as they are often misplaced or impacted.[32-34] Therefore, it is important that future studies consider using other teeth, such as second molars, to estimate legal adulthood, as has already been proposed by some authors.[35,36]

The study also analyzed a somewhat uneven sample, both in terms of sex and in the distribution of individuals above and below 18 years of age. As the sample is defined as a representation of a greater population, any hurdles in sample collection directly affect the inferences and results of the study.[37] This is a limitation that should be observed in the present study.

The use of Artificial Intelligence (AI) for age estimation through radiographic analysis has emerged as a promising alternative. Considering its performance comparable to that of human evaluators and advantages such as faster methodological processing and a lower risk of bias.[12,38] Murray et al. (2024)[39] highlighted that convolutional neural networks performed better in age estimation and in pattern recognition when compared with manual methods. Therefore, it is worth emphasizing that investing in AI-based research within forensic fields is essential.[12] However, in diverse contexts, such as regions with limited access to advanced technological resources, techniques, and methods previously applied to other populations should be considered and adapted according to the socioeconomic conditions of each region.[40]

CONCLUSION

The application of the methods proposed by Caggiano et al. (2022)[10], based on Demirjian et al. (1973)[8] stages, and Cameriere et al. (2008)[6] to third molars, using orthopantomograms in a Brazilian sample, showed moderate accuracy in estimating the legal age of 18 years. However, some limitations were observed, particularly related to the distribution of age groups and sex. Future research should explore the use of additional teeth to enhance the accuracy of age estimation in this population.

ACKNOWLEDGEMENT

This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) - Finance Code 001.

REFERENCES

1. Sartori VK, Júnior AR, Corazza PH, Bello YD, Boedi RM, Dallepiane FG, Dogenski LC, Linden MS, Trentin MS, De Carli JP. Accuracy of the third molar maturity index (I3M) for diagnosing the legal majority of young southern Brazilians. J Clin Exp Dent. 2024;16(4):e455-e462. doi: 10.4317/jced.61423
2. Brasil. Lei nº 10.406, de 10 de janeiro de 2002. Institui o Código Civil [Internet]. [cited 2025 May 09]; Available from: https://www.planalto.gov.br/ccivil_03/leis/2002/l10406compilada.htm.
3. Brasil. Decreto-Lei nº 2.848, de 7 de dezembro de 1940. Institui o Código Penal [Internet]. [cited 2025 May 09]; Available from: https://www.planalto.gov.br/ccivil_03/decreto-lei/del2848compilado.htm.
4. Olze A, Solheim T, Schulz R, Kupfer M, Schmeling A. Evaluation of the radiographic visibility of the root pulp in the lower third molars for the purpose of forensic age estimation in living individuals. Int J Legal Med. 2010;124(3):183–6. doi: 10.1007/s00414-009-0415-y
5. AlQahtani SJ, Hector MP, Liversidge HM. Brief communication: The London atlas of human tooth development and eruption. Am J Phys Anthropol. 2010;142(3):481–490. doi: 10.1002/ajpa.21258
6. Cameriere R, Ferrante L, De Angelis D, Scarpino F, Galli F. The comparison between measurement of open apices of third molars and Demirjian stages to test chronological age of over 18 year olds in living subjects. Int J Legal Med. 2008;122(6):493–497. doi: 10.1007/s00414-008-0279-6
7. Mincer HH, Harris EF, Berryman HE. The ABFO study of third molar development and its use as an estimator of chronological age. J Forensic Sci. 1993;38(2):379-390.
8. Dermijian A, Goldstein H, Tanner JM. A new system of dental age estimation. Hum Biol. 1973;45(2):211-227.
9. Tanner JM, RH Whitehouse, MJR Healy. A new system for estimating skeletal maturity from the hand and wrist, with standard derived from a study of 2,600 of healthy. British children. 1962.
10. Caggiano M, Scelza G, Amato A, Orefice R, Belli S, Pagano, S, Valenti C, Martina S. Estimating the 18-Year threshold with third molars radiographs in the Southern Italy population: Accuracy and reproducibility of Demirjian method. Int J Environ Res Public Health. 2022;19(16):10454.
11. Mazières O, Blanchard-Muller M, Vidal C, Cyteval C, Baccino E, Martrille L. Applicability of Cameriere's third molar maturity index on orthopantomograms and computed tomography scans from a French population. Forensic Sci Int. 2024;359:112024.
12. Upalananda W, Khwankaew K, Chormanee K, Chinkanjanaroj A, Pethpand T. Age estimation at 18-year threshold: comparing Demirjian and Cameriere's methods for Thais. J Forensic Odontostomatol. 2025;42(3):28.
13. Devi A, Keshena JR, Vidyahayati IL, Skripsa TH, Prabowo YB, Boedi RM. Third molar assessment for legal age determination in Indonesian juveniles using Demirjian method. Morphol. 2025;109(365):100951.
14. Müller R, Büttner P. A critical discussion of intraclass correlation coefficients. Stat Med. 1994;13(23-24):2465-2476.
15. Derksen BM, Bruinsma W, Goslings JC, Schep NW. (2024). The kappa paradox explained. J Hand Surg Am. 2024;49(5):482-485.
16. Koo TK, Li MY. A Guideline of Selecting and Reporting Intraclass Correlation Coefficients for Reliability Research. J Chiropr Med. 2016;15(2):155-163.
17. Landis JR, Koch GG. The measurement of observer agreement for categorical data. Biometrics. 1977;159-174.
18. Acharya AB. Age estimation in Indians using Demirjian's 8-teeth method. J Forensic Sci. 2011;56(1):124-127.
19. Zandi M, Shokri A, Malekzadeh H, Amini P, Shafiey P. Evaluation of third molar development and its relation to chronological age: a panoramic radiographic study. J Oral Maxillofac Surg. 2015;19:183-189
20. Gaêta-Araujo H, Oliveira-Santos N, Nascimento EHL, et al. A new model of classification of third molars development and its correlation with chronological age in a Brazilian subpopulation. Int J Legal Med. 2021;135**:**639–648. doi: 10.1007/s00414-020-02401-1
21. Pinheiro A, Franco R, Makeeva I, Bueno J, Miamoto P, Franco A. 30 years of the ABFO study: Reproduction in a Brazilian sample. Morphologie. 2023;107(358):100598.
22. Marrero-Ramos MC, López-Urquía L, Suárez-Soto A, Sánchez-Villegas A, Vicente-Barrero M. Estimation of the age of majority through radiographic evaluation of the third molar maturation degree. Med Oral Patol Oral Cir Bucal. 2020;25(3):e359.
23. Mohammed RB, Koganti R, Kalyan SV, Tircouveluri S, Singh JR, Srinivasulu, E. Digital radiographic evaluation of mandibular third molar for age estimation in young adults and adolescents of South Indian population using modified Demirjian' s method. J Forensic Dent Sci. 2014;6(3):191-196.
24. Angelakopoulos N, Merdietio Boedi R, Franco A. et al. Assessing subjectivity in dental age estimation: intra- and inter-observer reliability across four well established third molar evaluation methods. Int J Legal Med. 2025. doi: 10.1007/s00414-025-03616-w
25. Gambier A, Rérolle C, Faisant M, Lemarchand J, Paré A, Saint-Martin P. Contribution of third molar eruption to the estimation of the forensic age of living individuals. Int J Legal Med. 2019;133(2):625-632.
26. Shi L, Galić I, Anić-Milošević S, Banjšak L, Brkić H. Accuracy of second and third molar maturity indices, Olze, Haavikko, and Demirjian methods for 14-and 16-

year-old age thresholds assessment in Croatian children and adolescents. Int J Legal Med. 2024;138(6):2411-2425.
27. Cavrić J, Galić I, Vodanović M, Brkić H, Gregov J, Viva S, Rey L, Cameriere R. Third molar maturity index (I3M) for assessing age of majority in a black African population in Botswana. Int J Legal Med. 2016;130:1109-1120.
28. Balla SB, Galic I, Karunakar P et al. Validation of third molar maturity index (I3M) for discrimination of juvenile/adult status in South Indian population. J Forensic Legal Med. 2017;49:2–7. doi: 10.1016/j.jflm.2017.05.003
29. Cameriere R, Santoro V, Roca R, Lozito P, Introna F, Cingolani M, Galić I, Ferrante L. Assessment of legal adult age of 18 by measurement of open apices of the third molars: study on the Albanian sample. Forensic Sci Int. 2014;245c:205.e1–205.e5. doi: 10.1016/j.forsciint.2014.10.013
30. Cameriere R, Pacifici A, Viva S, Carbone D, Pacifici L, Polimeni A. Accuracy of Cameriere's cut-off value for third molar in assessing 18 years of age for legal purposes. Minerva Stomatol. 2014;63(9):283–294
31. Adhikari S, Bhattarai B, Shrestha S, Bali H. Prevalence of Third Molar Agenesis among Patients Visiting a Tertiary Health Centre in Nepal: A Radiographic Study. JNSPOI. 2024;8(2):62-66.
32. Nanda RS. Agenesia do terceiro molar no homem. Am J Orthod. 1954;40(9):698 – 706.
33. Anderson D, Thompson GW, Popovich F. Alterações dentárias evolutivas. Am J Phys Anthropol. 1975;43(1):95–102.
34. Pamukcu U, Ispir NG, Toraman Alkurt M, Altunkaynak B, Peker I. Evaluation of the frequency of third molar agenesis according to different age groups. Am J Hum Biol. 2021;33(3):e23487.
35. Cameriere R, Palacio LAV, Pinares J, Bestetti F, Paba R, Coccia E, Ferrante L. Assessment of second (I2M) and third (I3M) molar indices for establishing 14 and 16 legal ages and validation of the Cameriere's I3M cut-off for 18 years old in Chilean population. Forensic Sci Int. 2018;285:205-e1.
36. Suvarna M, Balla SB, Chinni SS, et al. Examination of the radiographic visibility of the root pulp of the mandibular second molars as an age marker. Int J Legal Med. 2020;134(5):1869–73. doi: 10.1007/s00414-020-02347-4
37. Nanjundeswaraswamy TS, Divakar S. Determination of sample size and sampling methods in applied research. Proc Eng Sci. 2021;3(1):25-32.
38. Lira-Pinho LM, Oliveira SCL, Viana JVF, Oliveira KB, Siqueira AM, Verde GMFL. Inteligência artificial na odontologia forense: avanços e aplicações na identificação. REASE. 2025;11(4):3476-3486.
39. Murray J, Heng D, Lygate A, Porto L, Abade A, Manica S, Franco A. Applying artificial intelligence to determination of legal age of majority from radiographic data. Morphologie. 2024;108(360):100723.
40. Almeida-Filho CL, Figueiredo MPM, Silveira GE, Eidelwein T. Desafios éticos para o uso de inteligência artificial na educação e na pesquisa. Campos Neutrais. 2024;6(3):220-243.