COMPARISON IN THE ESTIMATION OF THE AGE OF MAJORITY ACCORDING TO THE DEMIRJIAN INDICES AND THE THIRD MOLAR OF CAMERIERE USING CONE BEAM TOMOGRAPHY IN A PERUVIAN POPULATION

Comparación de la estimación de la mayoría de edad según los índices de Demirjian y el índice de madurez del tercer molar de Cameriere mediante tomografía computarizada de haz cónico en una población peruana

Martín Lopez-Muñoz,[1] Milushka Quezada-Márquez,[1] Roberto León-Manco,[1] Yris Chávez-Lazo,[2] Rocío Cárdenas-Angulo,[3] Maria Eugenia Guerrero.[4]

1. Universidad Peruana Cayetano Heredia, Faculty of Stomatology, Lima, Peru.
2. Universidad Nacional Federico Villarreal, Department of Radiology, Lima, Peru.
3 Private Practice, Lima, Peru.
4. Universidad Nacional Mayor de San Marcos, Medico Surgical Stomatology, Lima, Peru.

ABSTRACT

Objetive: To compare majority age estimation according to Demirjian's method and Cameriere's third molar maturity index using cone-beam computed tomography in patients who attended the Maxillofacial Diagnostic Institute during 2014-2018, Lima- Peru.
Material and Methods: A cross-sectional and analytical analysis was performed evaluating 492 lower third molars corresponding to 38 and 48 teeth. Patients included were between 12 and 23 years-old and were of both sexes. Data obtained were analyzed with a double entry frequencies distribution table. Sensitivity, specificity tests, and plotting on a ROC curve were selected to assess the methods capacity to estimate the majority age.
Results: Sensitivity values for Demirjian's and Cameriere's indexes were 0.80 and 0.70. Specificity values were 0.87 and 0.93, respectively. The AUC for Demirjian's and Cameriere's indexes were 0.84 (0.79-0.88) and 0.81 (0.77-0.86) respectively and the Delong test p-value was > 0.05.
Conclusions: There was no difference on majority age estimation accuracy according to Demirjian's method and Cameriere's third molar maturity index using cone-beam computed tomography.
Keywords: *Forensic dentistry; Cone-beam computed tomography; Forensic science; Molar, third; Methods; Sensitivity and specificity.*

RESUMEN

Objetivos: Comparar la estimación de la mayoría de edad según el método de Demirjian y el índice de madurez del tercer molar de Cameriere mediante tomografía computarizada de haz cónico en pacientes que acudieron al Instituto de Diagnóstico Maxilofacial durante el período 2014-2018, Lima, Perú.

Material y métodos: Se realizó un análisis transversal y analítico, evaluando 492 terceros molares inferiores correspondientes a 38 y 48 piezas dentales. Los pacientes incluidos tenían entre 12 y 23 años y eran de ambos sexos. Los datos obtenidos se analizaron mediante una tabla de distribución de frecuencias de doble entrada. Se seleccionaron pruebas de sensibilidad y especificidad, y se graficaron en una curva ROC para evaluar la capacidad de los métodos para estimar la mayoría de edad.

Resultados: La sensibilidad de los índices de Demirjian y Cameriere fue de 0,80 y 0,70. La especificidad fue de 0,87 y 0,93, respectivamente. El AUC de los índices de Demirjian y Cameriere fue de 0,84 (0,79-0,88) y 0,81 (0,77-0,86), respectivamente, y el valor p de la prueba de Delong fue superior a 0,05.

Conclusiones: No se observaron diferencias en la precisión de la estimación de la edad adulta según el método de Demirjian ni con el índice de madurez del tercer molar de Cameriere mediante tomografía computarizada de haz cónico.

Palabras clave: *Odontología forense; Tomografía computarizada de haz cónico; Ciencias forenses; Tercer molar; Métodos; Sensibilidad y especificidad.*

INTRODUCTION

The estimation of biological age is one of the key areas in the field of forensic medicine, not only in the investigation of crimes and accidents, but also when the chronological age of an individual is unknown and certain legal decisions may depend on their chronological age.[1,2] The majority of the age estimation literature concerned dental age estimation and the study of panoramic radiographs based on Demirjian's maturity scores.[3,4] However, third molars are three-dimensional (3D) structures that can be evaluated more precisely using 3D imaging modalities such as cone-beam CT (CBCT). The advantages of employing this technology in comparison to medical CT includes lower cost, higher voxel resolution, rapid scan time, lower radiation exposure and small field of view (FOV).[5] However there is a lack of scientific evidence that demonstrated good correlation between chronological age and 3rd molars development in different populations using CBCT.[6]

Human teeth can resist physical, chemical and mechanical factors.[7] To estimate the biological age of people between 12 and 23 years of age, several radiographic indicators can be used. Third molars have an initial intraosseous development whose evolution and calcification takes place during this period of time, culminating

around 23 years of age. Hence, third molars can be used to distinguish individuals below or above the age threshold of legal majority.[8] The third molar is the last tooth to calcify and close its root apices, allowing us to estimate dental age based on certain indices such as Demirjian's, which evaluates the mineralization of the third molar, or Cameriere's, which considers the degree of development and apical constriction for the determination of dental age.[9]

Standardize and specific formulas for specific populations to determine age estimation are required due to differences in ethnic and geographic backgrounds.[10] Peru has an overall ethnic heterogeneity and few studies have used the Demirjian classification system to correlate chronological age with mineralization stages in third molars in Peruvian population samples.[11]

The present study assessed and compared the sensitivity, specificity and accuracy of the Demirjian and the Cameriere third molar index for radiographic dental age estimation of female and male Peruvian subadults considering the age threshold of legal interest of 18 years using CBCT.

MATERIALS AND METHODS

This cross-sectional and analytical study was carried out after approval by the Institional Ethics Committee of the Universidad Peruana Cayetano Heredia (No. 102438). CBCT images were selected from the databank obtained at IDM Maxillofacial Diagnostic Institute, Lima, Peru, from January 2014 to December 2018.

The sample size was determined using the formula to estimate a probability with a total population of 682 CBCTs, at 95% confidence level, an event probability of 50% (This probability of chance is taken as a reference because there is no information from previous research in the same study population), and a precision of 5%. According to this analysis, the minimum number of CBCTs required was 246.

The inclusion criteria were patients with age ranging from 12 to 23 years old, presenting at least one mandibular third molar, third molars in vertical or vestibulo-lingual position. Exclusion criteria consisted of third molars associated with pathological changes (cyst or tumor), impacted third molars, and pronounced deviation of eruption path (ie, greater than 35°).

Only the age (declared at the radiological center) and the administrative sex were collected. No identification data were collected and images were automatically anonymized before the selection process in accordance with the ethical standards. Ethical

This research was carried out with the approval of the Research Committee of the Faculty of Stomatology of the Universidad Peruana Cayetano Heredia and the Institutional Ethics Committee of the Universidad Peruana Cayetano Heredia. The tomography scans were provided by the tomographic data bank of the Maxillofacial Diagnostic Institute. Since this information came from digital files, there was no contact with the patients and no informed consent was necessary, maintaining the anonymity of the origin of the tomographic images by generating a code for each patient.

Reliability

A pilot test was conducted on 25 CBCTs for each method in order to determine the sample size and to train and calibrate the observer. To discard any evaluating error, the training and calibration were performed by a specialist in Oral and Maxillofacial

Radiology with more than 15 years of experience (MQ). The calibration with the specialist was done two times with a washout period of four weeks. Data recorded were submitted for analysis of agreement to check the calibration and the kappa and ICC coefficients were 0.901 and 0.997 respectively indicating optimal agreement accepted to proceed with the research.

Image analysis

CBCT scans were acquired by the Promax 3D Mid tomograph (Planmeca®, Helsinki, Finland) and had a field size of 10x10cm and voxel size of 200 micrometres. The selected scans had exposure parameters of 90 kV and 14 mA. The chronological age of each subject was calculated as the difference between the birthdate and the date the radiograph was taken. In a dimly lit room, the specialist blinded for patients' age and sex classified the third molars according to their stages of mineralization based on the Demirjian classification,[12] D to H stages were used as cut-offs points to estimate adulthood. Also, third molars were evaluated according to Cameriere et al.[13] The apical ends of the third molars roots were analyzed, which was evaluated as the sum of the distances between the inner sides of the two open apices divided by tooth length. If the apical ends of the roots were completely closed, then the third molar maturity index = 0. A third molar maturity cut-off value of <0.08 was selected based on Cameriere et al.,[13] to discriminate adult patients.

The measurements were carried out with the Romexis 5.3 (Planmeca®, Helsinki, Finland). For the evaluation of the degree of root development and calcification of the

Table 1.
Evaluation of the Demirjian and Cameriere third molar indices in estimating the age of majority in women who attended the Maxillofacial Diagnostic Institute during the period 2014-2018.

Piece	Method		Over 18 years n	%	Under 18 years n	%	Total n	%	Kappa	Sensi-tivity	Speci-ficity	PPV	NPV	Accuracy
38	Camierere	Over 18 years	57	11.59	12	2.44	69	28.05	0.64	0.69	0.93	0.83	0.85	0.85
		Under 18 years	26	5.28	151	30.69	177	71.95						
		Total	**83**	**33.74**	**163**	**66.26**	**246**	**100**						
	Dermijian	Over 18 years	16	13.62	20	4.07	87	35.37	0.68	0.81	0.88	0.77	0.90	0.85
		Under 18 years	67	3.25	143	29.07	159	64.63						
		Total	**83**	**33.74**	**163**	**66.26**	**246**	**100**						
48	Camierere	Over 18 years	59	11.99	11	2.24	70	28.46	0.67	0.71	0.93	0.84	0.86	0.86
		Under 18 years	24	4.88	152	30.89	176	71.54						
		Total	**83**	**33.74**	**163**	**66.26**	**276**	**100**						
	Dermijian	Over 18 years	66	13.41	23	4.67	89	36.18	0.64	0.80	0.86	0.74	0.89	0.84
		Under 18 years	17	3.46	140	28.46	157	63.82						
		Total	**83**	**33.74**	**163**	**66.26**	**246**	**100**						
Total	Camierere	Over 18 years	116	23.58	23	4.67	139	28.25	0.65	0.70	0.93	0.83	0.86	0.85
		Under 18 years	50	10.16	303	61.59	353	71.75						
		Total	**166**	**33.74**	**326**	**66.26**	**492**	**100**						
	Dermijian	Over 18 years	133	27.03	43	8.74	176	35.77	0.66	0.80	0.87	0.76	0.90	0.85
		Under 18 years	33	6.71	283	57.52	316	64.23						
		Total	**166**	**33.74**	**326**	**66.26**	**492**	**100**						

n: Absolute frequency. **%:** Relative frequency. **PPV:** Positive Predictive Value. **NPV:** Negative Predictive Value

Table 2.

Evaluation of the Demirjian's method and Cameriere's third molar maturity index in estimating the age of majority in male using cone beam tomography in patients who attended the Maxillofacial Diagnostic Institute during the period 2014-2018.

Piece	Method		Over 18 years n	%	Under 18 years n	%	Total n	%	Kappa	Sensitivity	Specificity	PPV	NPV	Accuracy
						Chronological age									
38	Camierere	Over 18 years	33	6.71	6	1.22	39	39.91	0.66	0.73	0.91	0.85	0.84	0.84
		Under 18 Years	12	2.44	64	13.01	76	66.09						
		Total	**45**	**39.13**	**70**	**60.87**	**115**	**100**						
	Dermijian	Over 18 years	37	7.52	12	2.44	49	42.61	0.64	0.82	0.83	0.76	0.88	0.83
		Under 18 Years	8	1.63	58	11.79	66	57.39						
		Total	**45**	**39.13**	**70**	**60.87**	**115**	**100**						
48	Camierere	Over 18 years	33	6.71	6	1.22	39	39.91	0.66	0.73	0.91	0.85	0.84	0.84
		Under 18 Years	12	2.44	64	13.01	76	66.09						
		Total	**45**	**39.13**	**70**	**60.87**	**115**	**100**						
	Dermijian	Over 18 years	36	7.32	12	2.44	48	41.74	0.62	0.80	0.83	0.75	0.87	0.82
		Under 18 Years	9	1.83	58	11.79	67	58.26						
		Total	**45**	**39.13**	**70**	**60.87**	**115**	**100**						
Total	Camierere	Over 18 years	66	13.41	12	2.44	78	33.91	0.66	0.73	0.91	0.85	0.84	0.84
		Under 18 Years	24	4.88	128	26.02	152	66.09						
		Total	**90**	**39.13**	**140**	**60.87**	**230**	**100**						
	Dermijian	Over 18 years	73	14.84	24	4.88	97	42.17	0.63	0.81	0.83	0.75	0.87	0.82
		Under 18 Years	17	3.46	116	23.58	133	57.83						
		Total	**90**	**39.13**	**140**	**60.87**	**230**	**100**						

n: Absolute frequency. **%:** Relative frequency. **PPV:** Positive Predictive Value. **NPV:** Negative Predictive Value

third molar, each tooth was analyzed in sagittal, axial and coronal sections (MPR, Multi-Planar Reconstruction). First, the focal trough width was determined, which was 0.2 mm.

Then the contrast was varied and the axial, sagittal and coronal planes were aligned in the direction of the longitudinal axis of the tooth for the evaluation León. Then, using the measurement tools of the Romexis software, the internal width of the root pulp in open apices and the length of the tooth were measured.

Data analysis

The ages estimated by each of the methods were recorded and compared with the known chronological age of the participants. Descriptive measures of central tendency and dispersion were calculated. Sensitivity, specificity, positive and negative predictive values, and accuracy were calculated in SPSS version 24.0 software (IBM Corp, Armonk, NY, USA).

Cohen Kappa score (kappa) and intra-class correlation coefficient (ICC) were used to evaluate Demirjian's stages and third molar maturity index respectively for the intra-

Table 3.
Area under the curve ROC (Az) of the Demirjian and Cameriere third molar indices for estimating the age of majority in patients who attended the Maxillofacial Diagnostic Institute during the period 2014-2018.

METHODS			Az	95% CI	Standard Error
Piece 38	Female	Camierere	0.78	0.68 – 0.88	0.05
		Dermijian	0.85	0.77 – 0.84	0.04
	Male	Camierere	0.82	0.74 – 0.91	0.04
		Dermijian	0.83	0.74 – 0.91	0.04
	Total	Camierere	0.81	0.74 – 0.87	0.03
		Dermijian	0.84	0.79 – 0.90	0.03
Piece 48	Female	Camierere	0.82	0.72 – 0.91	0.05
		Dermijian	0.84	0.75 – 0.92	0.04
	Male	Camierere	0.90	0.84 – 0.96	0.03
		Dermijian	0.74	0.65 – 0.83	0.05
	Total	Camierere	0.82	0.76 – 0.89	0.03
		Dermijian	0.83	0.77 – 0.87	0.03
Total	Female	Camierere	0.80	0.73 – 0.87	0.04
		Dermijian	0.84	0.78 – 0.90	0.03
	Male	Camierere	0.90	0.84 – 0.96	0.03
		Dermijian	0.74	0.65 – 0.83	0.05
Total		Camierere	0.81	0.77 – 0.86	0.02
		Dermijian	0.84	0.79 – 0.88	0.02

Az: Area under the curve. **95% CI:** 95% confidence interval. **SE:** Standard error. ***:** DeLong test (*p*>0.05).

observer and inter-observer reliability. For each of the methods Kappa statistics was used to assess the agreement between methods on their performance for allocating individuals below or above the age threshold of 18 years. Confidence interval was set at 95% and statistical significance at 5%.

RESULTS

The age and sex distribution of patients who visited the Maxillofacial Diagnostic Institute between 2014 and 2018 was analyzed based on 246 volumetric tomography scans, of which 53.25% (n=131) corresponded to the female sex and 46.75% (n=115) to the male sex. The average age was 16.59 years (SD=2.99), for the female group it was 16.32

years (SD=2.93) and for the male group it was 16.90 years (SD=3.03). From these, 163 individuals were between 12 and 17.99 years old, while 83 were between 18 and 22.99 years old. The ranges obtained were 12-12.99 in 32 cases and 14-14.99 in 34 cases, and the lowest number occurred in the ranges of 19-19.99 in 9 cases and 22-22.99 in 8 cases.

For the evaluation of the Demirjian and Cameriere third molar indices in estimating the age of majority all the lower third molars present were included, making a total of 492 teeth examined.

For the Cameriere index, it was in agreement with chronological age in adults 23.58% (n=116), and in minors, 61.59% (n=303), with a Kappa index of 0.65, with a sensitivity of 0.70, and specificity of 0.93, the PPV (0.83),

Figure 1.

ROC curves of the Demirjian and Cameriere third molar indices for estimating the age of majority in patients who attended the Maxillofacial Diagnostic Institute during the period 2014-2018
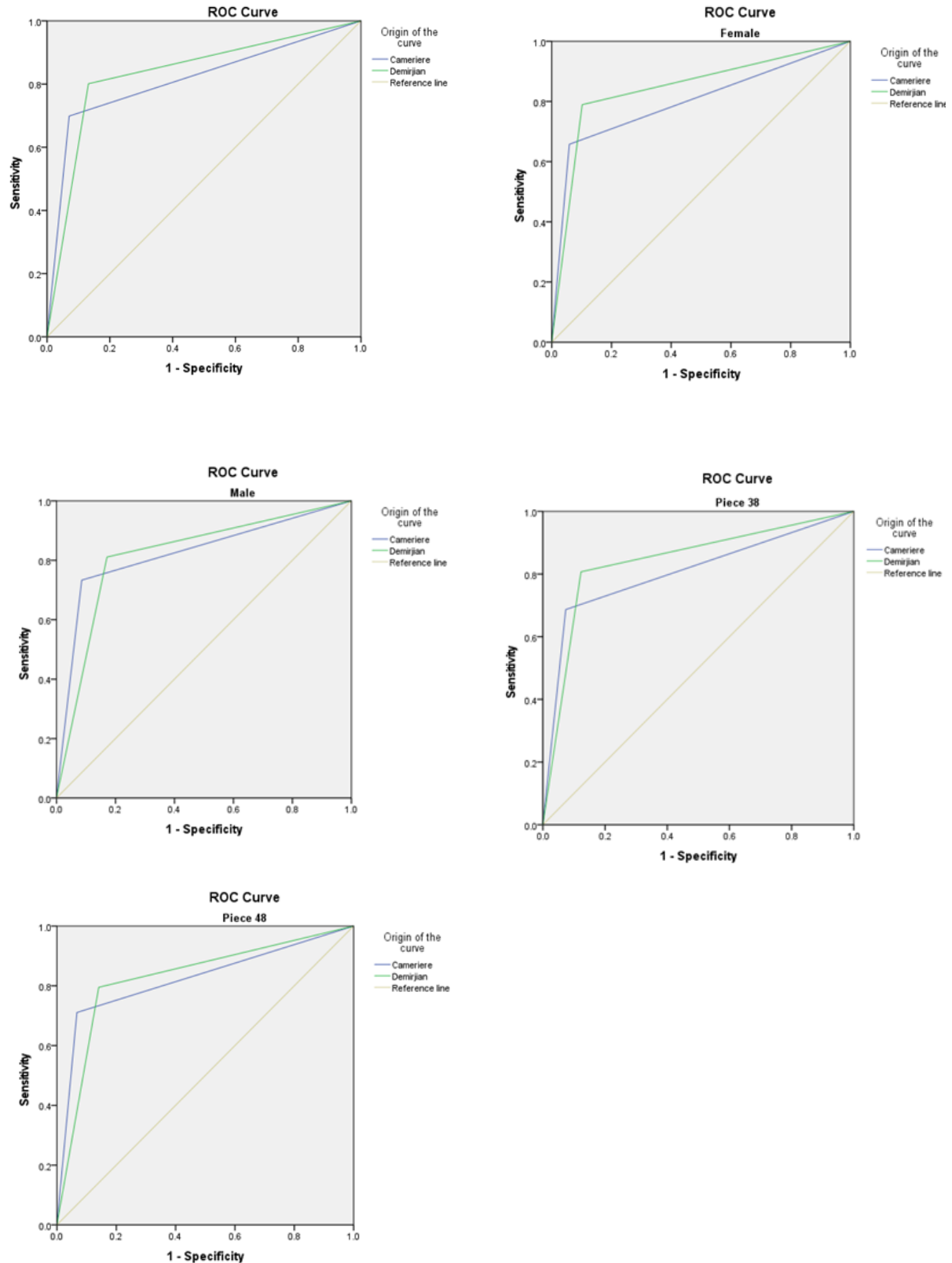
and the NPV (0.86) with an accuracy of 0.85. In the Demirjian index, it was found that it coincided with the chronological age in 27.03% of adults (n=133) and in minors in 57.52% (n=283), with a Kappa index of 0.66, sensitivity of 0.80, specificity of 0.87, with a PPV (0.76), and a NPV (0.90) with an accuracy of 0.85 (Figure 1).

When evaluating the Demirjian and Cameriere third molar indices in estimating the age of majority in females; 262 teeth were analyzed, corresponding to teeth 38 and 48, according to the Cameriere index, a coincidence with the chronological age was found in the majority of 10.16% (n=50) and in minors 35.57% (n=175), obtaining a Kappa index of 0.64, with a sensitivity of 0.66, specificity of 0.94, with a PPV (0.82), a NPV (0.87) giving an accuracy of 0.86.

According to the Demirjian index, when evaluating the teeth, it was found that they coincided with the chronological age in the adults in 12.20% (n=60) and in the minors in 33.94% (n=167), obtaining a Kappa index of 0.68, with a sensitivity of 0.79, specificity of 0.90, with a PPV (0.76), a NPV (0.91) with an accuracy of 0.87 (Table 1).

For the evaluation of the Demirjian and Cameriere third molar indices in estimating the age of majority in males; 230 analyzed teeth corresponded to teeth 38 and 48 according to the Cameriere index, in males, a coincidence with chronological age was found in adults in 13.41% (n=66) and in minors in 26.02%. (n=128), obtaining a Kappa index of 0.66, with sensitivity of 0.73, specificity of 0.91, with the PPV being (0.85), and NPV being (0.84) with an accuracy of 0.84.
According to the Demirjian index, a coincidence with chronological age was found in adults in 73 cases (14.84%) and in minors in 116 cases (23.58%), obtaining a Kappa index of 0.63, with a sensitivity of 0.81, a specificity of 0.83, with a PPV of 0.75, and a NPV of 0.87 with an accuracy of 0.82 (Table 2).

For the estimation of age of majority, a ROC curve of the Demirjian and Cameriere third molar indices were performed. The values of areas under the curve (Az) were analyzed, for the Cameriere index, the Az result being 0.81 (95% CI: 0.77-0.86) with a standard error of 0.02 and for the Demirjian index of 0.84 (95% CI: 0.79-0.88) with a standard error of 0.02. The comparison of the Az values according to the DeLong test did not find a significant difference between both diagnostic techniques in any of the cases (p>0.05) (Table 3).

DISCUSSION

There is always genuine interest in dental age evaluation, and this approach is a topic of discussion worldwide.[14] Forensic age estimation has become a challenging field in forensic science because population movements and immigration have increased due to political instability in many parts of the world and it is a key point as it has many implications for authorities.
Most of the time, reviewing administrative documents is not enough and authorities must order a forensic biological age examination.

Given the existence in our envi-ronment of different systems for estimating dental age and new technologies that allow new diagnostic tests to be performed, which in turn are comparable with those already existing, the question arises as to which method is better in terms of the accuracy of estimating dental age in our population.

This research attempts to elucidate whether the Demirjian index or the Cameriere third molar index is one of the best methods for estimating the age of majority in people whose ages were between 12 and 23 years. For this purpose, dental age was compared according to the Demirjian and Cameriere indices with chronological age, evaluating 246 volumetric tomography scans with a total of 492 teeth corresponding to lower third molars of individuals of both sexes of Peruvian nationality.

The results found in this study were that the Cameriere third molar index and the Demirjian index; both agreed in the estimation of chronological age of majority with dental age, in 23.58% (n=116) for the Cameriere index and in 27.03% (n=133) for the Demirjian index, however, the Cameriere agreed with the chronological age in the estimation of minority in 61.59% (n=303) and the Demirjian index in 57.52% (n=283). No statistically significant differences were found between both indices in the estimation of the age of majority.

The sensitivity and specificity found in this study for the Cameriere third molar index was 70% and 93% and for the Demirjian index it was 80% and 87%, results that agree with previous studies, with which high values of specificity (individuals under 18 years of age whose test was negative), this shows that the Cameriere third molar index is more useful for detecting minors (fewer false positives).

Similarly, for the Cameriere index, a PPV of 0.85 and 0.82 and a NPV of 0.84 and 0.87 were found for men and women respectively, and an overall value of 0.76 and 0.90 for the Demirjian index, which, associated with the high specificity, It would indicate a high probability of better detecting minors

and not making these types of errors. This results with high sensitivity and specificity values are in accordance with other studies like the study of De Luka et al.,[15] Franklin et al.,[16] Quispe et al.,[17] and Balla et al.,[18] Regarding PPV and NPV, our research coincides with that of Kumagai et al.,[19] Tafrount et al.,[20] Sharma et al.,[21] Kelmendi et al.,[22] De Luca et al.,[15] Franklin et al.,[16] Cavric et al.,[23] Galic et al.,[24] De Luca et al.,[25] Cameriere et al.,[26] Balla et al.,[27] and Kalinowska et al.[28]

Reducing technically unacceptable errors (adults classified as minors) is less significant for forensic purposes than reducing ethically unacceptable errors (minors labeled as adults).[29] Ribier et al.[30] reported lower specificities (88.23% for females and 88.35% for males), this variability could be due to a lower population sample studied.

One of the main limits of Cameriere's method is that a certain amount of inaccurate classifications occurs between the ages of 17 and 19. This concentration of errors in the year surrounding the 18 year threshold is unfortunately constant in the literature 31-33 and is not related to the third molar cutoff methodology.[14] It represents one of the main limits of this method and is more related to the body maturation process than the method itself. In the forensic field, there are technically and ethically unacceptable errors. The first category includes errors in judgment due to forensic age estimation that indicates that a subject over 18 years of age is a minor.

However, if a minor is declared an adult in a legal process, it is considered an ethically unacceptable error, since it implies a direct violation of the minor's rights. In this study, a PPV of 0.85 and 0.82 and a NPV of 0.84 and 0.87 for men and women respectively were

found for the Cameriere index, and an overall value of 0.76 and 0.90 for the Demirjian index, which, associated with the high specificity, would indicate a high probability of better detecting minors and not making these types of errors.

When evaluating the lower third molars according to the Demirjian index, Khosronejad et al.,[34] found that stages E and F determine the minority and G and H the majority. On the other hand, Maled et al.,[36] found that some older individuals were still in stage G according to Demirjian. Quispe et al.,[17] reported a greater sensitivity and specificity in stage H than in stage G.

Likewise, Quezada et al.,[36] when evaluating Peruvian individuals using panoramic radiographs in order to evaluate calcification of the lower third molar found that even in stage H, minor individuals can be found. These results are similar to those found in this study in which older individuals were found still in stage E according to Demirjian, which would indicate a delay in the development of the third molar, probably conditioned by geographical and multiracial variability such as the area in which the present study was developed.

In this study, Az values of 0.81 were found for the Cameriere index and of 0.84 for the Demirjian index. The comparison of these Az values was carried out with the DeLong test, and no significant difference was fo-und between both diagnostic techniques in any of the cases ($p > 0.05$). Quispe et al.,[17] found Az values of 0.970 for the Cameriere index and 0.667 and 0.866 for stages G and H according to the Demirjian index, values that would indicate that the precision of both tests is very high as the chronological age, it could be said that both indices are very precise in determining minority. This could be because

in young people the teeth are forming and constantly changing with intervals between the morphological stages being short, therefore, more precise.

From the medical-legal point of view, this study is important because it will allow us to specify which of the indices, the Cameriere or Demirjian, is more precise in determining the age of majority considering multiple factors that occur in our population such as: geographic, multiethnic, genetic variation, among others. and accordingly take the best option depending on whether you want to determine the minority or majority with greater precision. We recommend carrying out the study with a larger sample and compare it with other methods of determining dental age, for a better estimate of the chronological age of the individual.

CONCLUSIONS

There is no difference in precision in the estimation of the age of majority according to the Demirjian and Cameriere third molar indices using TCHC, but it was found that both methods better detect minors; however, when comparing both, the Demirjian's method is more precise for determining the age of majority according to sex, presenting greater sensitivity. No significant difference was found between the Az values since the area of the ROC curve for the Cameriere index was 0.81 and for the Demirjian index was 0.84.

CONFLICT OF INTERESTS

The authors declare that there are no conflicting interests.

ETHICS APPROVAL

Approved by the Research Committee of the Faculty of Stomatology of the Universidad Peruana Cayetano Heredia and the Institutional Ethics Committee of the Universidad Peruana Cayetano Heredia.

AUTHORS' CONTRIBUTIONS

Martín Lopez-Muñoz: Conception and design of the study, Data acquisition, Discussion of results, drafting.

Milushka Quezada-Márquez: study design, Data acquisition and interpretation.

Roberto León-Manco: Data analysis, drafting.

Yris Chávez-Lazo: Manuscript writing and interpretation.

Rocío Cárdenas-Angulo: Data acquisition and drafting.

Maria Eugenia Guerrero: Interpretation and revision.

All authors read and approved the final manuscript.

ORCID

Martín Lopez-Muñoz
 0009-0007-6668-3157
Milushka Quezada-Márquez
 0000-0002-7809-8744
Roberto León-Manco
 0000-0001-9641-1047
Yris Chávez-Lazo
 0000-0002-9453-0998
Rocío Cárdenas-Angulo
 0009-0009-1782-9070
Maria Eugenia Guerrero
 0000-0001-5425-870X

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