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Original Article

Use of the Chronological Dental Mineralization Table of Nicodemo, Moraes and Medici Filho (1974) to Estimate Age by Undergraduate Dentistry Students

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Abstract

Objective: To evaluate the agreement and applicability of the Chronological Dental Mineralization Table of Nicodemo, Moraes and Medici Filho (1974) to estimate age held by undergraduate Dentistry students at the Federal University of Paraíba. **Material and Methods:** Field research applied with a sample of 50 students according to inclusion and exclusion criteria. Sequentially, 3 panoramic radiographs were exposed (actual age known only by teachers), and students were instructed to interpret them from the selection of 2-4 teeth under formation. Data were analyzed using SPSS software (Statistical Package for Social Sciences), version 20.0, adopting significance level of 5%. **Results:** Most students chose 3 teeth, with percentages of 56.0% (n = 28); 38.0% (n = 19) and 58.0% (n = 29) for radiographs 1, 2 and 3, respectively. Teeth selected with greater frequency were: 47 (20.1%, n = 33) and 45 (19.5%, n = 32) - radiography 1; 38 (22.7%, n = 32) and 18 (13.4%, n = 19) - radiography 2; and 47 (17.9%; n = 26) and 36 (13.7%; n = 20) - radiography 3. The agreement between estimated and actual ages was 60.0% for radiography 1, 12.0% for radiography 2 and 32.0% for radiography 3. Age was underestimated in 40.0% (n = 20) and 88.0% (n = 44) in radiographs 1 and 2, respectively. Overestimation of the actual age occurred only in radiography 3 (68.0%; n = 34). The linear regression analysis revealed that it is possible to estimate the actual age from the maximum age stipulated by training students with 88.1% success rate. **Conclusion:** The method is applicable; however, the correlation between estimated and actual ages varied considerably among radiographs, and maximum estimated values were closer to the actual age than minimum values.

Keywords: Forensic Dentistry; Panoramic Radiography; Age Determination by Teeth.

Introduction

Since dawn of humanity, man seeks through different ways to determine factors involved in his development, as well as sex, age, height, ancestry and in vivo or post-mortem individual characteristics. Throughout the historical context, numerous cases have been reported on this theme, showing that the field of study of forensic and anthropological sciences is not a new area of research and follows the technical and scientific development as a way of progression for future actions [1].

Among the numerous legal investigations that can be carried out by the forensic dentist, surveys to estimate age stand out for being of great value in the national and international legal practice, as demonstrated in studies conducted in Canada [2], Colombia [3], Mexico [3], India [4], Serbia [5] and European countries of the Middle East [6].

These tests are used in different situations as to estimate the age of offenders, including, in the case of Brazil, in the age of criminal responsibility those aged 18 years or older, in addition to the adoption of children, obtaining documents, illegal immigrants, and for retirement purposes, in which this professional contributes to the enforcement of effective measures of the law [7].

In a second time for their social contribution, as the forensic examination of corpses, dental elements are characterized as good evidence for human identification. Teething, like fingerprints, are not the same among individuals, individualizing and hindering the similarity between the teeth of two or more people, being widely used in the event of disasters for human identification [7].

In this perspective, Brazilian authors [8-10] investigated the mineralization chronology of dental elements using the radiographic method. The first author studied the development of third molars; the second, incisors and first permanent molars, and finally, the third author focused on calcification of canines, premolars and second permanent molars.

However, during the mineralization process, teeth suffer influences that can speed up or slow down their development, and genetic changes and those stemming from ethnicity are the most varied and cited in literature [5,6]. In this context, at the national level, Brazil is a country with extensive territorial dimension, with mixed population, customs and cultural habits typical of each region, which makes the use of foreign parameters to estimate age not effective for investigations with Brazilian samplings [1,11].

Thus, Brazilian authors [8-10] in 1974 joined their findings to create the Permanent Teeth Chronological Mineralization Table, having the population of the state of São Paulo as reference, composed of white individuals of both sexes with age ranging from birth to 25 years. Since then, specifically for forensic science, this table has been used and recommended to guide investigations or age estimation studies in Brazil [12].

To reproduce the method, a single panoramic radiograph is necessary, from which information on dental elements under formation will be collected. The image of teeth will be compared to 8 drawings of the scheme proposed by the authors, and then, the probable age group is determined from the reference table for each of the analyzed teeth12. The last step consists of performing the intersection of age groups to establish the minimum and maximum estimated ages [13].

One of the current features of this issue is the hypothesis of not recommending the performance of the average age of selected teeth but an intersection of age groups, identifying the highest minimum age and the lowest maximum age [13]. Thus, the age estimation range in months is obtained, which is subsequently transformed into years. However, there is no consensus in literature about the best way to perform the interpretation of results through the use of the Chronological Mineralization Table.

Thus, the aim of this study was to evaluate the agreement and applicability of the Permanent teeth Mineralization Table of Nicodemo, Moraes and Medici Filho (1974) to estimate age by undergraduate Dentistry students at Federal University of Paraíba from panoramic radiographs.

Material and Methods

This work is characterized by being an applied, quantitative, exploratory, documentary, analytical and cross-sectional field study [14].

The study was carried out at the Federal University of Paraiba, Campus I, João Pessoa , Brazil, Health Sciences Center, during theoretical and practical classes of the Forensic Dentistry curriculum component, being submitted and approved by the Ethics Research Committee of the Health Sciences Center - UFPB (CAAE 25898113.8.0000.5188).

Universe and Sample

The universe was composed of all students currently enrolled in the Forensic Dentistry discipline in the second half of 2014 and first half of 2015, corresponding to a total of 56 students.

To participate, students should meet the following inclusion criteria: signing the Informed Consent Form and give their exercise of the age estimation practice for analysis. Those who were not present during the activity or did not correctly and completely fill the radiographic interpretation form were excluded from the study.

Non-probabilistic sampling was adopted, following the inclusion and exclusion criteria. Of the total students, 53 attended training and 3 were excluded because they failed to completely fill the radiographic interpretation form, resulting in a sample of 50 undergraduate students.

Data Collection

After the explanation of the theoretical framework about the age estimation methods by teachers, the practical activity for content fixing was conducted, focusing on the use of the Permanent teeth Chronological Mineralization Table of Nicodemo, Moraes and Médici Filho (1974) [12].

Through sequential projection of three panoramic radiographs with actual ages known only by teachers: 12 years and 0 months (Radiography 1), 15 years and 0 months (Radiography 2) and 07 years and 10 months (Radiography 3); students were asked to randomly choose between 2 and 4 developing dental elements (stages previous to complete mineralization) for each radiograph.

In addition, teachers recommended avoiding the selection of third molars, whenever possible, choosing these elements only in the absence of other permanent teeth with incomplete development and to select dental elements with better visualization and with greater certainty on their current development stage. These guidelines have been explained before the start of training to undergraduate students.

Subsequently, each participant received a form previously developed by the discipline containing three spaces for the interpretation of radiographs and further performance of age estimation with the aid of reference material related to the schematic drawing of mineralization stages (Figure 1) and the Permanent Teeth Chronological Mineralization Table of Nicodemo, Moraes, Medici Filho, 1974 (Frame 1).

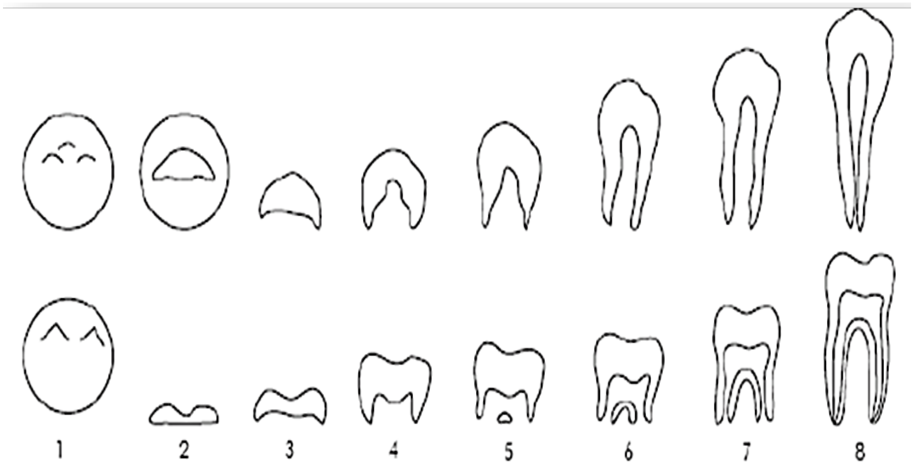

Figure 1. Illustration of the dental development degree according to Nicodemo, Moraes and Medici Filho (1974) [12].

After the selection of teeth, students compared the image of the selected elements to the diagram proposed by the authors (Figure 1), determining the mineralization stage, which ranges from 1 to 8, starting with the first signs of calcification (1) 1 / 3 coronary formation (2) 2/3 coronary formation (3) full crown (4), early root formation (5), 1/3 root formation (6), 2/3 root formation (7) up to the end of apical closure (8). Then, using the Mineralization Table (Frame 1), in which each dental group, upper and lower, presents an age range in months (minimum age and maximum age) for each corresponding stage. Thus, students performed the intersection of age groups obtained from the identification of the highest minimum age and lowest maximum age and completed the analysis after converting the estimated value found in months into years.

Frame 1. Permanent teeth Chronological Mineralization Table among Brazilians according to Nicodemo, Moraes and Medici Filho (1974) [12].

Tooth	First evidence of mineralization	1/3 crown	2/3 crown	Full crown	Early root formation	1/3 root	2/3 root	Apical end
TOP								
Central Incisor	5 - 7	8 - 15	18 - 30	36 - 57	60 - 78	75 - 90	87 - 108	100-116
Lateral Incisor	9 - 15	24 - 30	33 - 57	54 - 72	72 - 88	84 - 102	96 - 112	105-117
Canine	5 - 6	12 - 33	36 - 60	60 - 78	76 - 87	90 - 114	111 - 141	126-156
Premolar first	27 - 36	48 - 66	57 - 75	78 - 96	87 - 108	102 - 126	117 -133	129-159
Second Premolar	36 - 54	51 - 66	66 - 84	78 - 102	93 - 117	105 - 129	117 – 144	141-159
First Molar	1 - 6	6 - 16	18 - 30	36 - 48	54 - 66	66 - 84	75 - 96	90-104
Second Molar	39 - 57	52 - 66	69 - 84	81 - 102	102 - 126	120 -135	129 – 153	150-162
Third Molar	90 - 132	96 - 138	102 - 156	138 - 174	162 - 193	180 -204	192 – 234	216-246
LOWER								
Central Incisor	3,9 - 61	9 - 12	18 – 27	28-45	48 - 68	60 - 78	76 - 96	90 - 102
Lateral Incisor	4,6 - 58	7 - 12	18 – 30	18-66	54 - 78	68 - 88	80 - 99	92 - 102
Canine	4 - 7	8 - 30	24 – 54	51-72	69 - 93	84 - 108	105 – 135	129 - 156
Premolar first	27 - 36	45 - 60	51 – 72	69-90	84 - 102	102 -126	114 - 141	132 - 156
Second Premolar	33 - 54	48 - 63	66 – 81	78-96	93 - 144	108 -132	117 - 144	141 - 159
First Molar	1 - 6	6 - 12	18 – 28	18-45	54 - 66	57 -81	78 - 96	90 - 104
Second Molar	39 - 60	51 - 66	72 – 87	84-105	102 - 126	117 -135	129 - 153	150 - 165
Third Molar	90 - 132	96 - 138	102 -156	138-198	162 - 198	180 - 204	192 -234	216 - 246

Data Analysis

Data obtained were coded and entered into a database using the Microsoft Office Excel software (Windows XP, Microsoft, USA) and subsequently imported into the SPSS statistical software (Statistical Package for Social Sciences), version 20.0, in which descriptive and inferential statistical analysis was performed. It is noteworthy that, for the interpretation of information, confidence interval of 95% and significance level of 5% ($p < 0.05$) were adopted.

Estimation of the variation angular coefficient from the simple linear regression model was performed to evaluate the variation of the estimated age in relation to the actual age, previously known only by teachers and to develop a predictive model to estimate age from the use of the Mineralization Table of Nicodemo, Moraes and Medici Filho (1974), by analyzing the minimum and maximum ages obtained from the method.

Results

The study sample consisted of 54.0% (n = 27) of female participants and 46.0% (n = 23) of male participants with mean age of 24.8 (± 3.9).

Most students selected 3 teeth to perform the radiographic interpretation, 56.0% (n = 28) for the first radiography, 38.0% (n = 19) for the second and 58.0% (n = 29) for the third panoramic radiograph.

Table 1 shows the frequencies (absolute and percentage) of dental elements that have been chosen to carry out the radiographic interpretation. It was observed that for radiography 1, elements

47 (20.1%; n = 33); 45 (19.5%, n = 32) and 37 (16.4%, n = 27) were the most selected. For radiograph 2, third molars 18 (13.4%; n = 19); 28 (9.2%; n = 13); 38 (22.7%, n = 32) and 48 (11.3%, n = 16) were the most selected. Distribution was more heterogeneous for the third and last radiography, being more significant for teeth 46 (17.9%, n = 26), 45 (11.0%, n = 16) and 36 (13.7%, n = 20).

Table 1. Absolute frequencies and percentage of dental elements chosen to perform the radiographic interpretation. João Pessoa, Brazil, 2015.

Selected Dental Elements	Radiography 1 (12 years and 0 months)		Radiography 2 (15 years and 0 months)		Radiography 3 (7 years and 10months)	
	n	%	n	%	n	%
11	1	0.6	1	0.7	-	-
13	-	-	-	-	1	0.6
14	1	0.6	-	-	-	-
15	2	1.2	1	0.7	1	0.6
16	3	1.8	2	1.4	4	2.7
17	4	2.4	1	0.7	2	1.3
18	6	3.6	19	13.4	-	-
23	-	-	-	-	1	0.6
24	-	-	1	0.7	-	-
25	8	4.8	2	1.4	-	-
26	2	1.2	-	-	3	2.0
27	6	3.6	3	2.1	-	-
28	3	1.8	13	9.2	-	-
31	1	0.6	-	-	-	-
32	-	-	3	2.1	3	2.0
33	-	-	-	-	1	0.6
34	2	1.2	3	2.1	6	4.1
35	20	12.2	8	5.6	10	6.9
36	1	0.6	2	1.4	20	13.7
37	27	16.4	7	4.9	11	7.5
38	-	-	32	22.7	-	-
41	-	-	1	0.7	1	0.6
42	1	0.6	-	-	3	2.0
43	-	-	1	0.7	13	8.9
44	5	3.0	-	-	11	7.5
45	32	19.5	3	2.1	16	11.0
46	4	2.4	8	5.6	26	17.9
47	33	20.1	14	9.9	12	8.2
48	2	1.2	16	11.3	-	-
Base(*)	164	100.0	141	100.0	145	100.0

(*) Base and not total was used because more than one tooth per radiography analyzed was selected.

As for the mineralization stage of the selected elements (Table 2) in radiography 1, the results showed a greater predominance of stage 7, corresponding to 2/3 root formation (67.6%, n = 111). In radiography 2, stage 8 (39.7%, n = 56) relative to teeth in the apical end were the most selected. In radiography 3, distribution of close frequencies with predominance of stages 7 (33.7%; n = 49), 6 (23.4%; n = 34) and 5 (22.0%; n = 32) was observed, respectively corresponding to 2/3 root formation, 1/3 root formation and early root formation.

Table 2. Absolute frequencies and percentages of mineralization stages of teeth selected for radiographic interpretation. João Pessoa, Brazil, 2015.

Mineralization stages	Radiograph 1		Radiograph 2		Radiograph 3	
	n	%	n	%	n	%
1	2	1.2	-	-	-	-
2	-	-	2	1.4	-	-
3	6	3.6	23	16.3	2	1.3
4	5	3.0	33	23.4	18	12.4
5	2	1.2	19	13.4	32	22.0
6	15	9.1	-	-	34	23.4
7	111	67.6	8	5.6	49	33.7
8	23	14.0	56	39.7	10	6.9
Base (*)	164	100.0	141	100.0	145	100.0

(*) Base and not total was used because more than one tooth per radiography analyzed was selected.

Cases of agreement (agreement between estimated and actual age), situations where the age was underestimated (actual age was higher than the estimated age) or overestimated (actual age was lower than the estimated age) were also evaluated. This characterization is shown in Table 3 and demonstrate that age was underestimated in 40.0% (n = 20) and 88.0% (n = 44) from the interpretation of radiographs 1 and 2, with no cases of underestimation in radiography 3. However, overestimation of the actual age occurred only in the interpretation of the third panoramic radiograph (68.0%; n = 34).

Table 3. Absolute frequency and percentage of agreement with the actual age, underestimation or overestimation for each radiograph. João Pessoa, Brazil, 2015.

	Radiograph 1 (12 years and 0 months old)		Radiograph 2 (15 years and 0 months old)		Radiograph 3 (7 years and 10 months old)	
	n	%	n	%	n	%
Agreement	30	60.0	6	12.0	16	32.0
Underestimation	20	40.0	44	88.0	-	-
Overestimation	-	-	-	-	34	68.0
Total	50	100.0	50	100.0	50	100.0

The results presented in Tables 4 and 5 indicate that there are significant correlations between actual values and minimum and maximum estimated values, with stronger correlation between the estimation of maximum values, compared to the minimum values for age [14].

Table 4. Spearman correlation coefficients and hypothesis testing (null for lack of association between estimated values on radiographs for ages) in the method of Nicodemo, Moraes and Medici Filho (1974) and actual age. João Pessoa, Brazil, 2015.

Estatistics	Minimum age (years)	Maximum age (years)
Correlation coefficients	0.782	0.886
p-valor	0.000	0.000
Number of observations	150	150

Table 5 contains the adjusted model for age estimation, where it was observed that, by linear regression analysis, the actual age can only be estimated by the maximum values assigned by students for the method used to estimate age ($p < 0.001$), since for the minimum age, regression analysis showed no correlation between actual and predicted values ($p > 0.05$).

Table 5. Linear regression analysis to assess the relationship between actual age and the method of Nicodemo, Moraes and Medici Filho (1974) to estimate age by undergraduate students. João Pessoa, Brazil, 2015.

Model	Unstandardized coefficients		t test	p-value	Confidence Interval to B (95.0%)	
	B	Standard error			Minimum	Maximum
Maximum age	1.233	0.109	11.260	0.000	1.016	1.449

The results in Table 6 demonstrate the equation by which, from the maximum age estimated by the method under study, it is possible to estimate the actual age with accuracy of 88.1% (R^2 = determination coefficient).

Table 6. Model estimated to represent the relationship between actual age and age estimated by the students using the method of Nicodemo, Moraes and Medici Filho (1974). João Pessoa, Brazil, 2015.

Estimates parameters	Equation	Confidence limit of the mean (95%)
Maximum age 1.116	Age=1.116 x Maximum age RX (R^2=88.1%)	$\pm$1.11

Figure 3 shows the dispersion of values for estimated age assigned by students for each of the radiographs, with their actual ages. A higher concentration of values corresponding to the actual values for the ages studied in radiographs 1 and 3 was observed, but for radiography 2, a large dispersion of estimated values was observed, ranging from 11.2 to 18 years, which illustrates the lowest percentage of agreement found for this radiographic image.

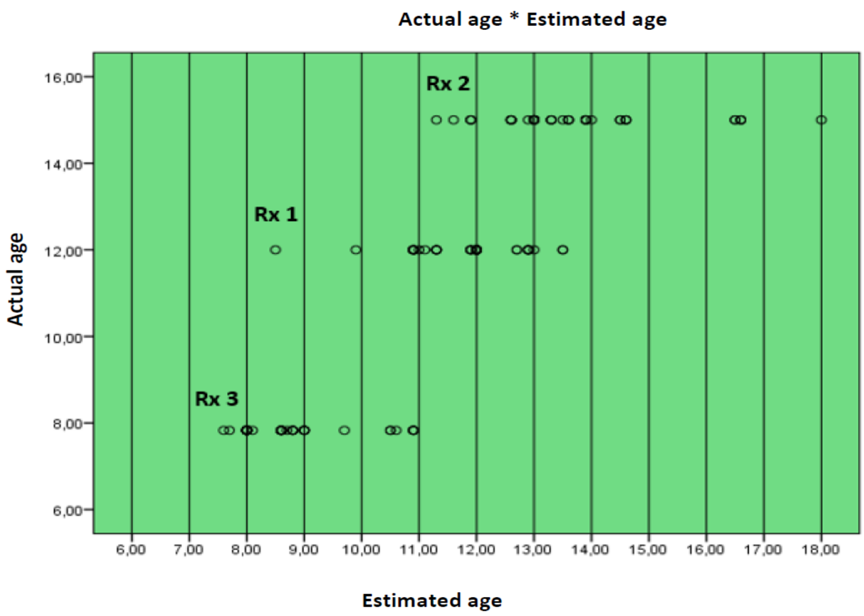

Figure 3. Graphic distribution of values for the maximum estimated age compared to the actual age in each of the radiographs (Radiography 1 = actual age of 12 years; Radiography 2 = actual age of 15 years; Radiography 3 = actual age of 7 years).

Discussion

Even with the advances in forensic sciences, estimating age, both in living subjects as in corpses and bones, remains a global problem [2]. Specifically for living individuals, this investigational exam is generally required with a view to criminal responsibility, which varies widely among nations, being at the age of 12 years in the United States, 14 years in Canada, 16 years in Russia and 18 years in most countries. Given this variation, it is difficult to select a single method to accurately estimate the age groups of interest, in addition to the ethnic heterogeneity that influences results [3,5].

In Brazil, the legal age is considered when the individual reaches the age of 18 years, and judicial measures are taken in different ways from this condition. Many offenders take advantage of this condition, hiding the age in search of milder measures as defined in the Child and Adolescent Statute [15]. Furthermore, crime rates are high among minors, increasing the volume of age estimation tests to be performed in Brazil, unlike the scenario in developed countries [16].

Internationally, in addition to these facts, attempts to dual citizenship and armed conflicts result in an increase in the number of immigrants and asylum seekers, respectively. In these situations, the number of foreigners is increasing in several countries, with dubious information about their nationality and age, which illustrates the importance of forensic investigations to estimate age also in the civil sphere [5,6].

Given these legal aspects in the context of forensic sciences, it is of medical and dental responsibility the reliability of investigation reports, and cases of age under- or overestimation can compromise judicial measures to be taken, as evidenced in previous studies [16,17].

The choice of the number of teeth for age estimation varied among panoramic radiographs due to the availability of dental elements under formation stages that could be used in the method. In younger individuals, such as radiographs 1 and 3, there is a large number of available information, different from radiography 2, in which tooth maturation is nearly completed, reducing the amount of information up to be restricted solely to third molars [17].

In individuals close to eighteen years of age, only the third molars provide information, which should not be considered in isolation. Thus, similar to the other identification procedures, the greater the number of information obtained, in this case from teeth, the better and more reliably the method achieves the expected purpose. Some authors have pointed out that using this method, when the evaluation of 4 dental elements is performed, the results found seem to be the most suitable methodology for the agreement of chronological age and estimated age, especially for analysis in the age group of 10-15 years [9,11].

There is a greater predominance in this situation for choosing lower teeth especially mandibular molars in both radiographs as parameter for the method. This fact can be explained by their morphology, radiolucency and location, and because they are major elements, with well demarcated radiopacity, located in better radiographic viewing areas and with earlier formation compared to upper elements [18].

These features can facilitate the determination of the mineralization stage and the radiographic differentiation of deciduous and permanent teeth, the former not being applied to the method. Regarding the anatomical location, the mandibular region has a greater and thicker bone area with fewer structures that could superimpose images during the radiographic procedure, thus contributing to a better view of the lower elements [18].

The choice of the dental element is a crucial factor for obtaining satisfactory results on the use of certain methods. Some teeth provide more accurate and reliable estimates than others, and the choice of these elements, as well as the exclusion of those with infectious, degenerative or hyperplastic processes facilitate the achievement of consensus between estimated and actual age [16,19].

The interpretation of the mineralization stages is an important step for forensic examinations that can generate doubts and opens room for differentiated analyses, classifying teeth into earlier or later stages than they actually are. Thus, there is need for the calibration of examiners in order to prevent erroneous measurements from assessment errors [1].

These stages are important criteria in the age estimation processes that, in case of doubt, the observer should always chose for the most advanced stage that has been reached. That is, if the radiographic appearance of a tooth classifies it between two phases, one must not interpolate among existing phases, not necessarily consider the closest stage, but rather the stage that was actually achieved [20].

As for the agreement, the radiographs of younger individuals, as in radiographs 1 and 3, which respectively correspond to the age of 12 years and 0 months to 7 years and 10 months, showed higher percentages of agreement, corroborating the results of other studies that also used the Chronological Mineralization Table of Nicodemo, Moraes and Medici Filho (1974) [16,21].

However, the age group 15-18 years is of great interest in the context of forensic dentistry given its applicability in tests to determine legal age, and yet, it is still the age group of greatest difficulty in correctly estimating the age of individuals, as was also reported in another study with similar methodology [11].

Some researchers indicate the third molar as the best option and with greater chances of success in cases of individuals aged 14-22 years [3,4,22]. However, in this study, in radiography 2, only 12.0% of participants reached an agreement between actual age and that estimated by the method, and for this panoramic radiograph, the third molars were the most selected teeth and with the lowest value in percentage of agreement for the three radiographs.

This fact shows that the association with other parameters such as sex, height, development of gonads, as well as the repetition of the forensic method, and even the application of other techniques is necessary to estimate age, thus seeking to minimize professional errors given the limited resources of national Forensic Medicine Institutes. In this study, the only information provided during the training of students were the panoramic radiographs without contextual specifications of cases, and the Dental Mineralization Table was the only resource provided, thus hindering examination.

In the linear regression, it was observed that the values obtained for the correlation are positive, which means that the estimated results follow the actual values, so that when the actual value increases, the estimated value also increases, being often a very wide age range, thus negatively contributing to accurately determine the chronological age.

Such values provide subsidies to state that the actual age is significantly associated with the maximum age stipulated by students, as a determination coefficient of 88.1% was obtained. It is noteworthy that this percentage of diagnoses consistent with the actual age was achieved by students who experienced the newly acquired knowledge in the forensic dentistry discipline. Thus, it is believed that the application of this method by experienced professionals can increase its agreement percentage.

In the analysis of the determination coefficient, values above 0.8 indicate correlations with excellent internal consistency. For samples with number fewer than 200, values above 0.6 are already considered suitable so that the classification can be as follows: 0.70-0.79 (suitable); 0.80-0.84 (good) and from 0.85, excellent [23].

Thus, conversion methods determined from the dental age should be adjusted to the ethnicity of the population to which age estimation is intended, proposing correlation factors to make the method applicable and reproducible [24].

Some authors consider that for an individual assessment, it would be more advantageous to use a model with more precise categorization of young people because it would minimize the likelihood of violation of children and adolescents' rights by imposing tougher penalties than those legally enforceable [25]. The results of this investigation fit into such a situation, as shown in Table 3, and age was overestimated only for the last individual, which is in line with literature [26-28].

Many Forensic Medicine Institutes of Brazil do not have equipment to perform imaging tests on their premises, either due to the lack of maintenance or to investments, hindering the age estimation investigation [18]. In developed countries, this scenario appears to be different, since institutes have equipment for such a purpose, quickly obtaining radiographs and availability to perform CT scans of execution and / or resonances for the elaboration of reports. Moreover, these institutes have advanced technological apparatuses and digital procedures for identification such as virtual biopsies, which facilitate the performance of forensic investigations [16].

In addition to the necessary infrastructure, ethical issues are internationally discussed, since the use of ionizing radiation does not provide a dosage to be considered safe, being used for still questionable therapeutic purposes, especially in unaccompanied children [18].

Studies like this involving undergraduate students contribute to literature updates about the educational scenario of forensic and anthropological sciences in the context of universities. At the same time, they are interesting because they enable students through one of the methods most widely used in the country for purposes of estimating age for future works in the legal area. In a Latin American survey [29], the authors concluded that the academic load is insufficient, both theoretical and practical, for the teaching of this discipline in Latin America, given the diversity of methods, techniques and dental procedures, similar to that found in European countries [30].

The present study has limitations such as the use of a small sample, which was intentionally and not randomly chosen, and participants are individuals in the same experience condition because they are all undergraduate Dentistry students. Another study limitation is the reduced number of radiographs used, which could not be modified because the study was developed based on a practical activity already carried out by the forensic dentistry discipline and under analysis for some semesters.

Therefore, future studies involving this issue should be carried out in order to reach a consensus in literature about choosing the best method to estimate age. The richness of classifications, the study population, methodologies adopted and observers are factors that make the comparison among studies difficult and therefore the decision-making about their applicability and reproduction. The union of different methods increases the amount of information and contributes for a result of higher accuracy and reliability.

Conclusion

It was concluded that the correlation between estimated age, from the interpretation of panoramic radiographs using the Chronological Mineralization Table of Nicodemo, Moraes and Medici Filho (1974), and the actual age of individuals varied among radiographs, showing age overestimation in older individuals. To improve the applicability of this method in the Brazilian population, correlation factors should be used for each study, and maximum values estimated by undergraduate students are closer to the actual age compared to values estimated for the minimum age.

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