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Correlation between Chronological Age and Pulp-Tooth Dimensions in Mandibular First Premolars

A CBCT Study

Omar Basheer Taha Al-Tekreeti, Noor Sabah Irhayyim
College of Dentistry, University of Tikrit, Tikrit, Iraq

Abstract

One of the crucial elements of applied forensic research is estimating age, facilitating the identification of unidentified human remains. Teeth are favored because of their durability against environmental and post-mortem alterations. This research evaluated linear measurements of pulp and tooth using cone-beam computed tomography (CBCT) images and pulp-to-tooth ratio measures of mandibular first premolars (M4) for age estimates in an Iraqi demographic utilizing ordinal logistic regression (OLR). A retrospective examination of 400 CBCT images (600 M4) was performed. Measurements of linear and ratio dimensions were acquired from the sagittal, coronal, and axial planes. Four OLR models, both inclusive and exclusive of sex, were evaluated to ascertain prediction accuracy and identify the most significant variables. Age had a negative correlation with most parameters, particularly with pulp length on the sagittal plane. The maximum accuracy of 63.3% was attained through the integration of linear measurements and pulp-tooth ratio measurements.

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Email: dr.omar.b@tu.edu.iq

Introduction

In anthropology and forensics, determining the age of an object is of paramount importance. This is very significant for finding out the biological profile of unidentified human remains since it helps narrow down the search for who they are. This method is sometimes used to find out how old criminals, terrorists, and refugees are when their birth records are missing or out of date. Teeth are easier to date than other bones since genetics, nutrition, and hormones don't affect them as much [1].

Forensic scientists utilize teeth to figure out who owns unidentified human remains because they are loaded with minerals that help them survive adverse conditions. Due of their exceptional efficacy in exclusion, they are employed in nearly all forensic examinations of human remains. The study also reveals that teeth can assist in telling how old someone is [2].

The pulp chamber diminishes in size with age due to the continuous deposition of secondary dentin. Researchers have demonstrated that two-dimensional (2D) X-ray imaging of the teeth can provide an accurate evaluation of the age of the pulp and teeth [3].

Three-dimensional (3D) radiographs are widely used in the maxillofacial region [4-6] and they have successfully addressed this constraint by offering detailed information about teeth, including accurate assessments of the pulp chamber's morphology and its physiological changes accompanying aging [4].

The 3D radiography procedure breaks an object up into very small pieces that are usually between 0.13 and 1 mm thick. This approach with a high resolution can provide you very accurate measurements of many things including [5], the size and shape of the tooth and pulp [6].

Researchers can analyze the temporal fluctuations in pulp size and the development of secondary dentin by employing these morphometric data. There is a relationship between chronological age and this age-related change in the tooth pulp [7]. To determine age, researchers have utilized many approaches to evaluate changes in dental structure, including histological, biochemical, and genetic techniques; however, these techniques are predominantly invasive, often involving the removal of teeth [9-11].

Radiographic examination is a nondestructive method currently preferred for age estimation [11]. To get the proper output, the radiographical assessment has to go through many

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processes. In these phases, the picture is cut up, some sections are taken out, and it is put into a group or a number [8]. It may be possible to figure out exactly how old people are by using numerical categorization and to figure out what age group a person belongs to by using categorical classification. The effectiveness of each method depends on how well the tooth sizes match up [8].

Several studies have utilized the pulp-to-tooth ratio derived from CBCT radiographs to ascertain an individual's age [4,9-11]. These investigations employed either linear regression or multinomial regression models. This study aimed to examine age estimation using CBCT images of the M4, as the M4 has never been examined in the age estimation of the Iraqi population before, through an ordinal logistic regression model (OLRM), as it is the first time to use this test, seeking to elucidate the influence of sex on age estimation and to assess the sufficiency of linear measurements of the pulp and tooth for age estimation, or whether the computation of the pulp-to-tooth ratio can yield superior results.

This research aimed to evaluate the linear measurements of pulp and tooth using CBCT images and pulp-to-tooth ratio measures of M4 for age estimates amongst the Iraqi population utilising ordinal logistic regression. The null hypothesis of this study asserts that the chronological age cannot be accurately estimated using the linear measurements of M4 obtained from CBCT images of M4.

Material and Methods

Study design

The ethical approval for this study (Approval of project no. 11125, reference no. 11) was granted by the Ethics Committee of the College of Dentistry at the University of Tikrit. On 30 September 2025. The informed consent was relinquished. This retrospective cross-sectional study analyzed 400 CBCTs from the data pool at GAMA clinics in Baghdad City, Iraq. M4s were included from both right and left sides when present and eligible. Laterality was not documented, as prior CBCT morphometric investigations have reported no statistically significant bilateral differences in premolar pulp or tooth dimensions [9,10]. Accordingly, teeth from both sides were pooled and analyzed at the tooth level rather than the subject level.

Inclusion and exclusion criteria

The study included 400 CBCT images. According to the age of the cases, the measurement applied on 600 M4 (300 male, 300 female). The side (right or left) was not recorded; the sample is classified as the following depending on the study of [9]:

Young = From 15-29 years old (200 teeth, 100 males, 100 females)

Middle age = From 30-49 (200 teeth, 100 males, 100 females)

Old = From 50-older (200 teeth, 100 males, 100 females)

Based on the given criteria, radiographs of cases over 15 years old with at least one M4 in the CBCT and no cavities, fractures, or dental restorations. Blurred radiographs or misaligned M4s that showed signs of root canal therapy, apical periodontitis, additional osseous lesions, root resorption, calcified roots, or evidence of prior orthodontic treatment were not included.

Sample size calculation

An a priori power analysis was conducted in G*Power (v3.1.9.4) using the multiple-regression (R^2 deviation from zero) framework as a conservative proxy for ordinal logistic regression. Assuming 18 predictors, $\alpha = 0.05$, power = 0.80, and an anticipated effect size of $f^2 = 0.078$ ($\approx R^2 \approx 0.07$), the required sample size was N = 273, and the target recruitment was ~400 participants. We enrolled 400 cases (200 M4 per age group); these variables were distributed across six OLR models according to the type of measurements and sex inclusion. No actual attrition existed, in spite of the allowance of 10% attrition being incorporated at the planning stage as a precautionary measure. The whole data were available for all included cases.

The CBCT measurements

Although the study is retrospective, it is worth mentioning the protocol used in capturing the CBCTs. The Rainbow machine (Rainbow, South Korea) was used to capture the CBCT images (used in this study) depending on the conventional protocol. The scanning procedure took about 19 seconds, and the subjects were supervised to ensure that they did not move during scanning. The scanning protocol was tube voltage: 120 kVp, tube current: 3-7 mA, image acquisition of 0.5 mm voxel size, and F.O.V. 8 x 8 x 8.

Linear measurements of 600 M4, regardless of the side, were acquired in multiplanar views (axial, coronal, and sagittal planes) as shown in Figs. 1-3. DICOM data were entered, and linear measurements were executed using the RadiAnt Imaging viewer software (version, 2025.1, Medixant, Poland) on an Msi laptop manufactured by Micro-Star International, Taiwan.

For the sagittal section, the section showing the maximum mesiodistal linear measurement at the cementoenamel junction (CEJ) level of each M4 (left or right) was picked, and the ensuing measurements were carried out at the CEJ level:

1. "Meso-distal linear measurement of the tooth on the sagittal section (MDTS), the linear measurement between the most mesial point of the tooth and the most distal point of the tooth."
2. "Meso-distal linear measurement of the pulp on the sagittal section (MDPS), the linear measurement between the most mesial point of the pulp and the most distal point of the pulp."
3. "Crown length (CL), the linear distance from the highest point in the occlusal surface measured perpendicularly to the MDTS line."
4. "The height of the pulp chamber (HPC): the perpendicular linear distance between the highest point of the pulp horn (PH) and of the MDTS line."

For the measurements of pulp and tooth in the coronal section, the axis was aligned with the long axis of the tooth on the sagittal section. Subsequently, the coronal slice displaying the maximum buccolingual width of the crowns of the M4 was selected, and all mea-surements of the coronal section were documented as determined by this reference as follows:

1. "The width of the tooth at the plane of CEJ (CTWCEJ) is the linear measurement between the most buccal and lingual sites of the M4."
2. "Coronal pulp width at level CEJ (CPWCEJ) is the extent between the most buccal and the most lingual sites of the pulp."
3. "Coronal tooth width at level PH (CTWPH), the linear measurement between the most buccal and the most lingual sites of the tooth at the M4 end of the pulp cavity."
4. "Coronal pulp width at the plane of the PH (CPWPH), the linear measurement between the most buccal and the most lingual end of the pulp at the M4 end of the PH."

On the axial section, the M4 was aligned along its long axis, and axial sections were scrolled apico-coronally. The selected section corresponded to the most apical slice in which enamel was still circumferentially visible, immediately before its disappearance, representing the CEJ level (Figures 1, 2, and 3):

1. "Bucco-lingual linear measurement of the pulp on the axial section (BLPA), the measurement between the most buccal and lingual end of the pulp."
2. "Pulp width on the axial section (PWA), the linear distance extending between the most mesial site and the distal end of the pulp cavity."
3. "Bucco-lingual distance of the tooth on the axial section (BLTA), the distance from the most buccal point of the tooth to the most lingual site of the M4 crossing the pulp chamber."
4. "Tooth width on the axial section (TWA), the linear distance from the most mesial to the distal end of the tooth by crossing the pulp chamber."

The pulp-tooth ratio (PTR) calculated for:

1. MDPS/MDTS = (MDPTSR).
2. CL/HPC = (HR).

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3. CPWPH/CTWPH = (CPTRWPH).
4. CPWCEJ/CTWCEJ = (CPTRWCEJ).
5. PWA/TWA = (PTRWA).
6. BLPA/BLTA= (BLPTRA).

Calibration (Reliability analysis)

The dependability of the methodologies was validated by doing repeated assessments after a two-week gap to alleviate memory bias subsequent to the initial evaluation, corroborated by almost a decade of expertise in evaluating digital radiography.

The reliability of the 12 measured parameters through inter-examiner and intra-examiner calibration (ICC) was assessed. The lead investigator randomly chose 10% (n = 60) of people for a reassessment. The lead investigator and specialist of oral radiology not mentioned in the authors list selected 10% of cases randomly and did the measurements on the same cases. For inter-examiner calibration, values ranged from 0.765 to 0.843, indicating "good" to "excellent" reliability. Similarly, intra-examiner calibration showed slightly higher consistency across all metrics, with values ranging from 0.768 to 0.848. Notably, all parameters, including MDTS, HPC, and PWA, achieved high statistical significance with p-values < 0.0001, confirming the robustness and reproducibility of the measurement protocols used in this study.

Statistical analysis

We used the Statistical Package for Social Sciences (SPSS), version 26, made by IBM Corporation in Armonk, NY, USA, to look at all the traits of 300 M4 from both the right and left sides. The Shapiro–Wilk test of normality test was utilized to evaluate the normality of the data. All parameter showed p-values less than 0.05, so they were not normally distributed. Mann-Whitney test was used to compare the mean ranks of nonparametric data. To see how strong the associations were, the Spearman correlation coefficients were calculated. We used ordinal regression analysis to forecast age, with age being the dependent variable. A p-value of less than 0.05 was considered statistically significant.

Four models were suggested, and an equation of each model was applied for the whole dataset to test which model can give the best accuracy.

The models were as follows:

1. Model A: All the linear measurements only, without sex.
2. Model B: all the linear measurements only with sex.
3. Model C: The pulp-tooth ratio measurements without sex.
4. Model D: The pulp-tooth ratio measurements with sex.
5. Model E: All the linear measurements only + the pulp-tooth ratio measurements without sex.
6. Model F: All the linear measurements only + the pulp-tooth ratio measurements with sex.

Since this study was intended as an exploratory analysis with balanced age- and sex-stratified groups and data partitioning would have decreased statistical power and model stability, model validation was not carried out. Therefore, rather than creating a fully validated predictive tool, which should be the focus of future research, the models were designed to compare the relative contributions of morphometric variables.

Results

The HPC and PLPA were the only metrics that didn't demonstrate significant variations between the male and female groups. While regarding the values of the pulp/tooth ratio measurements, only the MDPTSR, HR, and CPTRWPH were significantly different between the sexes, as shown in Table 1.

The results of Spearman correlation analysis revealed significant negative correlations between age and several variables, including MDTS, MDPS, CL, HPC, PWA, PLPA, PLTA, TWA, MDPTSR, HR, CPTRWCEJ, PTRWA, and BLPTRA (all $p < 0.05$). Among these, PLPS ($\rho = -0.564$) and PWA ($\rho = -0.517$) showed the strongest associations, indicating that as age increases, these measurements tend to decrease, as shown in Table 2. The results of OLR for each model are shown in table 3: the most accurate model was Model E (63.1%), followed by Model F (60.17%) and Model B (60.0%); the weakest one was Model C (49.83%) in table 3. The powerful parameters were MDPS, MDTS, HPC, and PWA.

Overall, MDPS, MDPTSR, PLPR, PWR, and PWA were the most powerful parameters. The sex and the ratio measurements showed limited productive value.

Discussion

Estimating dental age is the most accurate way to find out someone's age if they do not have a formal birth document [10]. Ways to guess someone's age include a full physical exam, looking at the growth of the hand-wrist skeleton on radiographs, the maturation of the cervical vertebrae, and the development of the sternoclavicular joint [11]. But teeth are the least affected bodily part by taphonomic processes when it comes to estimating age. This extraordinary longevity frequently renders them the sole remnants accessible for study in specific instances [12].

The M4 was selected for this study due to its superior functional longevity in the oral cavity and the most extensive pulp chamber among all single-rooted teeth [13]. The measurements were applied on 600 M4s with equal sample size of the sexes and age group. This study did not consider the side of the tooth that had been examined as there are studies showed that the right and left side premolars yielded similar results [14,15], that is why side was not registered.

Radiography is essential in forensic dentistry, especially for the identification of individuals. It also helps figure out the individual's demographic details [12,14-16]. CBCT makes it possible to take high-quality, low-radiation 3D pictures of teeth. CBCT enhances structural visualization and diagnostic precision by regulating magnification, removing superimposition and geometric distortion, and presenting multiplanar and three-dimensional images [14,15].

The linear measurements used in this study exhibit significant differences between the sexes, and this comes in accordance with one study [14], while another study showed non-significant difference between sexes; that is can be attributed to the difference in the methods of measuring the tooth and pulp or to difference in populations.

The findings indicated a robust correlation between linear measures across all planes and the chronological age of the samples, especially MDPS, MDPTSR, PLPR, PWR, and PWA, which were the best age indicators. These findings are like the earlier research that successfully adopted root canal thickness as a representative measure for assessing formation of secondary dentin [2,17-36]. A gradual increase in dentinal thickness occurs with aging, especially along the pulpal walls and less so along the pulpal roof. The results of this study support this finding [16-19], except for Lee et al. [20]. Consequently, our findings indicate that horizontal dimensions provide a more reliable basis for age estimation. The limited benefit of vertical measurements for age appraisal may be linked to the confounding influence of external variables, like attrition, occlusion type, or behavioral habits, with teeth attrition exhibiting a more significant correlation to diet and habits [2,21].

Most of the studies depended on pulp/tooth ratio [9,22]; however, our study depended on linear measurements of the tooth and pulp and the ratio between them. Previous studies used linear regression or multilinear regression tests, the dependent variable was the age in number [6,23], [24]. In this study, measurements were carried out on M4 of the Iraqi population, and an equal number of sex and age groups was chosen for better results (young, middle, and old), those three age cohorts represent key biological and legal milestones: 15–29 (legal thresholds and maturation), 30–49 (stable dentin for high accuracy), and ≥50 (increased variability requiring

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independent modeling). This framework ensures forensic reliability by addressing the non-linear nature of dental aging and international identification standards [25-28].

The ordinal regression test was selected for testing the study parameters, as the groups were arranged in an ordinal manner. The authors believe this is the first study to use M4 in the Iraqi population for age estimation and the first study to use an ordinal regression test.

Age estimation using the outcomes of the measurements done on M4 can give satisfactory accuracy in the Tunisian population [22]. In this study, the accuracy of model C was the lowest one 49.83%. The model showed the better accuracy was Model F in 63.3% of cases; however, sex showed no effect on the accuracy when used with ratio values Model D&F, and even in Model B the effect was approximately 1%. Model B showed 60%. In model F, sex decreased the accuracy, as the accuracy decreased from 63.3% to 60% when the sex was added to the predictive parameters. These findings indicate that age-related secondary dentin deposition, rather than sexual dimorphism in tooth size, is the primary factor influencing pulp dimensional changes in mandibular first premolars. This comes in accordance with previous studies [22,23].

As the highest accuracy was 63.3%, the model demonstrated a moderate ability in the age group differentiation using measurements applied on CBCT images. This result validates its use as an additional tool in forensic odontology, especially for identifying unidentified remains or identifying victims of disasters where mandibular teeth are preserved. However, the method should be used in conjunction with established age estimation techniques because it is inappropriate for precise legal age determinations due to overlap between adjacent age groups.

Populations may exhibit variations in pulp dimensions due to factors such as nutritional and hormonal fluctuations, as well as specific systemic diseases [2]. Because of these traits, different studies have come up with different ways to estimate the age of their populations [2,37-51]. The deposition of secondary dentin differs according to tooth type, sex, and demographic factors [29]. Local factors, like secondary dentin deposition or tertiary dentin deposition at the chamber ceiling from decay or restorations, can change the size of the pulp cavity. To avoid this issue, only sound teeth were selected to be studied, depending on Kvaal's protocol [30].

Models A–F had moderate predictive accuracy (49.8%–63.3%), which suggests that individual-level classification is limited and that outcome categories overlap. While models based only on tooth-pulp ratio variables performed worse, the use of linear variables may have introduced multicollinearity, affecting coefficient stability. The added value provided by sex was inconsistent. The proportional odds assumption of OLR was not statistically examined. The results are relevant to the Iraqi population, but it is unclear whether they can be applied to other populations.

And in other hand, the limitation of this retrospective study is that the teeth could not be assessed clinically, with lacking the history of the patients studied. The calcification of pulp can be affected by various conditions of the patients like the lifestyle, periodontal disease, and systemic disorders, which affect the morphological measurements of the pulp [7,46]. Furthermore, this study uniquely targeted on linear measurements of the M4, whereas the remaining teeth were not taken into consideration.

Studies of the age effect on other types of teeth, such as canines or molars, of the Iraqi population are recommended to be investigated.

Conclusion

The use of the M4 method for age prediction in forensic dentistry in the present investigation demonstrated acceptable reliability. The findings contribute additional evidence to the forensic dentistry literature. Sex showed limited contribution to age prediction, whereas linear measurements, particularly MDPS, emerged as strong indicators of age category.

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Table 1. Comparison of the linear measurements of the pulp and tooth and the ratios of the pulp/tooth of the linear measurements.

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Data are presented as median (IQR). Gender comparisons were performed using the Mann–Whitney U test. Effect sizes are expressed as rank-biserial correlation (r_rb); negative values indicate higher measurements in males, and positive values indicate higher measurements in females. Values of approximately 0.10, 0.30, and 0.50 represent small, moderate, and large effects, respectively.

Parameter	Sex	N	Median	IQR	MEan	p-value	Effect size (r_rb)
MDTS	Male	300	5.71	0.93	5.72	<0.0001	-0.28
	Female	300	5.30	0.73	5.44		
MDPS	Male	300	1.03	0.34	1.06	<0.0001	-0.21
	Female	300	0.93	0.40	1.03		
CL	Male	300	6.62	1.33	6.65	<0.0001	-0.20
	Female	300	6.42	1.23	6.27		
HPC	Male	300	1.62	0.90	1.65	0.48	0.03
	Female	300	1.70	0.88	1.66		
CTWCEJ	Male	300	6.95	1.14	7.00	0.0001	-0.19
	Female	300	6.72	1.04	6.76		
CPWCEJ	Male	300	1.50	0.50	1.56	0.0001	-0.18
	Female	300	1.43	0.50	1.45		
CPWPH	Male	300	0.77	0.33	0.81	0.018	-0.11
	Female	300	0.74	0.27	0.76		
CTWPH	Male	300	7.50	1.23	7.64	0.018	-0.12
	Female	300	7.37	1.00	7.49		
PWA	Male	300	1.05	0.39	1.09	0.002	-0.15
	Female	300	0.96	0.34	1.01		
PLPA	Male	300	1.97	0.84	2.00	0.659	0.02
	Female	300	2.04	0.67	1.99		
PLTA	Male	300	7.32	0.79	7.35	0.003	-0.14
	Female	300	7.26	0.60	7.19		
TWA	Male	300	5.41	0.67	5.47	<0.0001	-0.38
	Female	300	5.07	0.54	5.1		
MDPTSR	Male	300	.1796	0.05	0.16	0.016	-0.11
	Female	300	.1696	0.05	0.18		
HR	Male	300	0.25	0.13	0.25	0.0047	0.13
	Female	300	0.27	0.10	0.26		
CPTRWPH	Male	300	0.22	0.06	0.22	0.0021	-0.12
	Female	300	0.21	0.06	0.21		
CPTRWCEJ	Male	300	0.11	0.04	0.11	0.0797	-0.08
	Female	300	0.10	0.04	0.10		
PTRWA	Male	300	0.19	0.07	0.19	0.9953	0.00
	Female	300	0.19	0.06	0.19		
BLPTRA	Male	300	0.28	0.12	0.27	0.1694	0.06
	Female	300	0.28	0.09	0.28		

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Table 2. Spearman correlation coefficient for the whole parameters.

Variable	Spearman Correlation (ρ)	p-value
MDTS	-0.466	<0.001
MDPS	-0.564	<0.001
CL	-0.421	<0.001
HPC	-0.367	<0.001
CTWCEJ	0.054	0.184
CPWCEJ	0.064	0.118
CPWPH	-0.115	0.005
CTWPH	0.047	0.246
PWA	-0.517	<0.001
PLPA	-0.301	<0.001
PLTA	-0.183	<0.001
TWA	-0.214	<0.001
MDPTSR	-0.429	<0.001
HR	-0.238	<0.001
CPTRWPH	0.048	0.242
CPTRWCEJ	-0.133	0.001
PTRWA	-0.458	<0.001
BLPTRA	-0.272	<0.001

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Table 3. The forecasting equation of age estimation of the models derived for the ordinal logistic regression test.

Model	Equations	Accuracy %
Model A	logit[P(Y ≤ 0)] = -10.488 - (-0.759*MDTS - 2.490*MDPS - 0.355*CL - 0.364*HPC - 0.869*PWA - 0.450*BLPA) logit[P(Y ≤ 1)] = -8.451 - (-0.759*MDTS - 2.490*MDPS - 0.355*CL - 0.364*HPC - 0.869*PWA - 0.450*BLPA)	59.0%
Model B	logit[P(Y ≤ 0)] = -12.278 - (-0.814*MDTS - 2.682*MDPS - 0.449*CL - 0.810*PWA - 0.400*BLPA + 0.733*Gender(0)) logit[P(Y ≤ 1)] = -10.197 - (-0.814*MDTS - 2.682*MDPS - 0.449*CL - 0.810*PWA - 0.400*BLPA + 0.733*Gender(0))	60.0%
Model C	logit[P(Y ≤ 0)] = -7.156 - (-13.936*MDPTSR - 2.987*HR - 8.510*PTRWA - 3.905*BLPTRA) logit[P(Y ≤ 1)] = -5.418 - (-13.936*MDPTSR - 2.987*HR - 8.510*PTRWA - 3.905*BLPTRA)	49.83%
Model D	Gender non- significant	N/A
Model E	logit[P(Y ≤ 0)]= −20.199−(-11.817*PLPS+9.350*PWA−2.067*TWA+53.955*PLPR−57.323*PWR logit[P(Y ≤ 1)] = −18.109−(-11.817*PLPS+9.350*PWA−2.067*TWA+53.955*PLPR−57.323*PWR	63.3%
Model F	logit[P(Y ≤ 0)]= -21.83 –(-11.995*PLPS - 0.685*CL + 10.637*PWA - 2.509*TWA - 63.898*PWR - 0.749(Gender(0)) logit[P(Y ≤ 1)]= -19.70 –(-11.995*PLPS - 0.685*CL + 10.637*PWA - 2.509*TWA - 63.898*PWR- 0.749(Gender(0))	60.17%

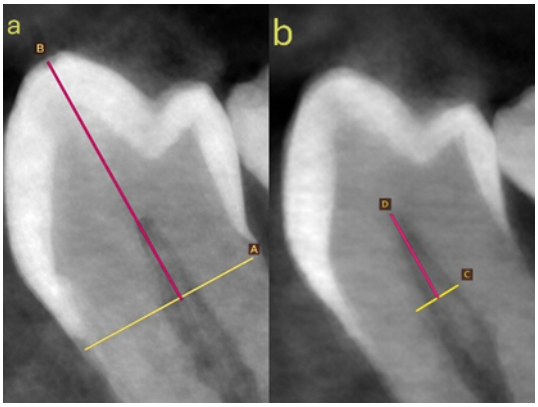


Figure 1. Linear measurements collected from the sagittal views (a, b) “Linear measurements done on sagittal section A. Meso-distal linear measurement of the tooth on cementoenamel junction. B. Meso-distal linear measurement of the pulp on cementoenamel junction. C. The height of the tooth. D. The height of the pulp chamber.”

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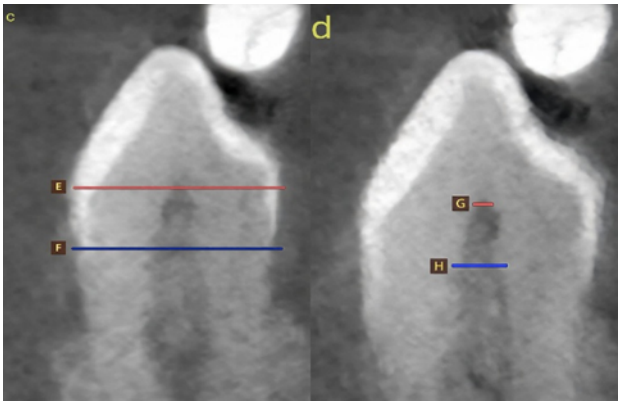


Figure 2. Linear measurements collected from the coronal views (c, d) “Linear measurements done on coronal section E. The width of the tooth at the plane of CEJ. F. The width of the pulp at the plane of CEJ, G. Coronal tooth width at the plane of the PH, H. Coronal tooth width at the plane of the PH.”

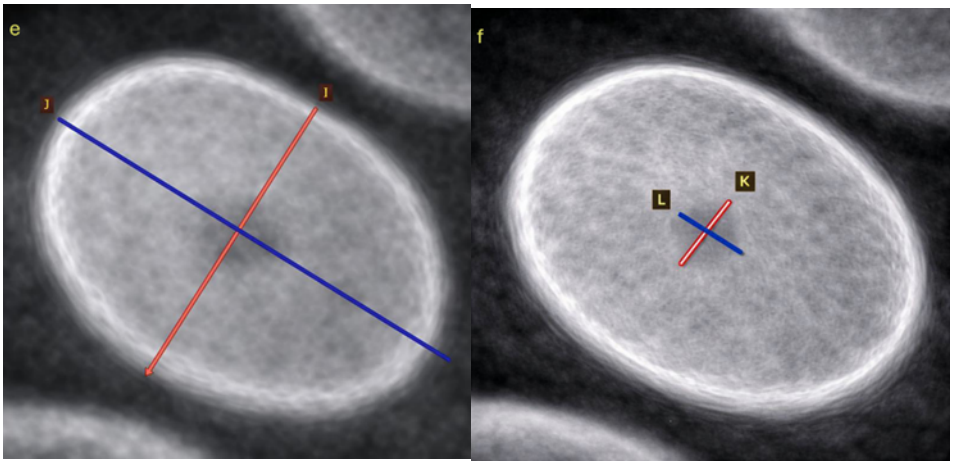


Figure 3. Linear measurements collected from the axial views (e, f) “Tooth measurements on axial section I. Bucco-lingual distance of the tooth on the axial section, J. Tooth width on the axial section. The pulp liner measurement on axial section K. Pulp width on the axial section, L. Bucco-lingual linear measurement of the pulp on the axial section.”