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RESEARCH ARTICLE

ASSESSMENT OF AGE BASED ON THE PULP CAVITY WIDTH OF THE MAXILLARY CENTRAL INCISORS

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ABSTRACT

Aims and Objectives: Based on the radiographic evaluation of the pulp cavity width of the maxillary central incisors the age of the patients belonging to the age group of 15 – 50 years was estimated, those attending the Department of Oral Medicine and Radiology, Patna dental college and hospital, patna-4, based.

Materials and Methods: The study group comprised of 240 subjects. Intraoral periapical radiographs of the maxillary central incisors were taken for all subjects, using the conventional paralleling angle technique and the pulp cavity width was measured at the cervical and middle third using a digital vernier caliper. The data obtained was subjected to correlation and regression analysis.

Results: A negative linear relationship was obtained between the age and pulp cavity width (cervical third, r = -0.459 and middle third, r = -0.704). Cubic regression analysis was done and the regression formulae were obtained. A mean difference of 0.1 years was obtained between the estimated age and real age, indicating the reliability of the derived formula.

Conclusion: It can be concluded that the width of the pulp cavity of maxillary central incisors are reliable for estimation of age.

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INTRODUCTION

Age is an important aspect in most cultural and judicial system and has assumed increasing importance for the assessment of both criminal culpability and legal/social categorization. It also constitutes an important factor in the identification of an individual in forensic odontology. Most of age estimation methods described in literature offer an approach in the form of preparation of microscopic sections of teeth. The demerits of the above procedures are that they are irreversible, as the tooth structures may not be available for employing other age estimation methods, and moreover, it may not be acceptable for ethical and religious reasons. (Salariya and Gorea, 2010) In such circumstances, age estimation through radiographs is more suitable as it can easily clarify issues with significant legal and social ramifications for individuals as well as for the community. Age estimation techniques developed over the years, using radiographs, were based mostly on developmental stages of the tooth, however, when they were applied at large among different age groups, the results was found to be futile. Age-related changes occur in teeth approximately between 10 weeks *in utero* to old age. (Datta and Sood, 2012) As the age advances, the volume of the pulp cavity gradually decreases because of the secondary dentin deposition in the pulp cavity wall. (Singaraju and Sharada, 2009) These morphological changes in the pulp cavity serve as one of the most promising predictors for age estimation. In light of the above factors, the aim of our study was to estimate the age of the patients based on the radiographic evaluation of the width of the pulp cavity of the maxillary central incisors.

MATERIALS AND METHODS

A total of 240 subjects (120 males and 120 females) reporting to the Department of Oral Medicine and Radiology, Patna

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Dental College and Hospital, Patna 4, were selected for the study. The patients enrolled in the study belonged to the age group of 15–50 years. Patients with full complement of sound maxillary central incisors, with an integrated dentition and good occlusion, were considered for the study. Patients with history of parafunctional habits, developmental anomalies of the teeth, impacted anterior teeth, trauma from occlusion, fracture were excluded from the study. The selected sample was subjected to conventional intraoral periapical radiographs of the maxillary central incisors using the paralleling angle technique taken at standard parameters with proper radiation protection measures. The radiographs were processed with a constant strength of developing and fixing solutions, as recommended by the manufacturer. Measurements of the central incisors were recorded from the radiographs using a magnifying glass, a radiographic viewer, and a digital vernier caliper with 0.01 mm calibration. The pulpal cavity width (mesio-distal diameter) was measured at the cervical portion of the tooth and middle third of the root. The recorded measurements were entered in the proforma specially designed for the study and the final data was subjected to statistical analysis using the SPSS software 17.0 version. The Pearson's correlation test was performed to determine the correlation between the pulp cavity width and age. Regression analysis was carried out to obtain the cubic regression formula for age estimation. The Student's t-test was performed to compare the mean estimated age with the known mean age of the individual.

RESULTS

The mean real age was 36.03 years in males and 36.30 years in females. The mean values of the cervical third pulp cavity width in males and females were 3.67 mm and 3.52 mm, respectively. The mean values of the middle third pulp cavity width in males and females were 1.92 mm and 1.80 mm, respectively. Student's t-test was performed for comparing the mean values of the pulp cavity width at the cervical and middle third in males and females. No statistical significant difference was observed in the cervical and middle third pulpal widths in males and females (Table 1). This suggested that no definitive sex difference could be made considering the width of the pulp cavity. Therefore, we had to determine the correlation and cubic regressions for males and females on the whole.

The Pearson correlation was performed between the width of the cervical and middle third of the pulp cavity and age. A negative linear relationship was obtained between the age and pulp cavity width (cervical third, r = - 0.459 and middle third, r = - 0.704) (Figures 1 and 2). This was suggestive of the fact that as age increases, the pulp cavity width decreases. A strong correlation was observed with the middle third of the root canal when compared to the cervical third of the pulp cavity. Cubic regression analysis was performed with age as a dependent factor and the pulp cavity width as an independent factor. In order to obtain an estimated age, the cubic functions were calculated using the formula, $y = ax3 + bx2 + cx + d$, Where, y is the estimated age and x is the sum of the corresponding pulp widths at the cervical and middle third regions, respectively. The regression formula obtained in our study is — $Age = 0.106*x3+ (-18.274*x) + 117.26$. The mean real age obtained in the study was 36.16 years. The mean estimated age obtained in the study using the regression formula was 36.17 years. Student's t-test revealed no significant difference (P = 0.998) between the estimated age and real age (Table 2).

DISCUSSION

Estimation of the human age at time of death is often an important step in the identification of human remains. (Singaraju and Sharada, 2009) Although several parts of the body can be used for age estimation, the poor condition of the remains often prevent their use. However, the teeth are usually more resistant to peri- and postmortem tissue altering effects. (Jeevan *et al*., 2011) In the present study, the maxillary teeth were used, as they are more convenient for age determination than mandibular teeth. Brkic *et al*. found that the teeth of both jaws were reliable for dental age estimation, but the correlation coefficient was stronger for all types of teeth in the upper jaw. (Brkic *et al*., 2006) In addition, Fancy *et al*. stated that the growth layers of maxillary teeth were more regular and distinct than those of mandibular teeth. (Fancy, 1980) Among the maxillary teeth, the central incisors were preferred as they are single rooted teeth, and the pulp cavity width is comparatively greater. In the previous studies, the ratios between the tooth and pulp measurements, such as, the pulp ⁄ tooth length and the pulp ⁄ tooth width at different levels, were calculated and used in the analyses to reduce the possible variation because of the angulation of the radiographs. (Sharma and Srivastava, 2010; Drusini, 2008; Saxena, 2011) In the present study, we have considered the mesio-distal diameters of the pulp cavity (rather than the ratio of pulp/root width) at two levels, as the predictors for age estimation. It is known that under physiological conditions the volume of the pulp cavity gradually decreases with age, because of the secondary dentin deposition in the pulp cavity wall. This was in agreement with the present study, where we found a negative correlation between age and the pulp cavity width. Similar results were seen with Du *et al*., Agematsu *et al*., and Zaher *et al*. (2011, 2010 & 2004) Singh *et al*. (2004), evaluated the physiological changes. in the teeth

Table 1. Comparison of mean age, cervical and middle third pulp cavity widths in males and females

Variables	Male Mean	Male SD	Female Mean SD	Female SD	P-value
Age(years)	36.03	10.55	36.30	10.54 ±0.890	NS
Cervical third pulp cavity width (mm)	03.67	0.63	03.52	00.48± 0.140	NS
Middle third pulp cavity width (mm)	01.92	0.44	01.80	00.37± 0.134	NS

Table 2. Student's t-test between mean estimated age and mean real age

	Mean	N	Std. deviation	Std. error	mean P value
Real age	36.16	240	13.361	1.329	0.998
	0.998				
Estimated age	36.17	240	08.813	0.876	

N = Sample size, P value < 0.01 significant

with advancing age and found a a mean difference of ± 2.16 years between the actual and calculated ages. (Singh *et al*., 2004) Zaher *et al*. (2011), proved that the estimated ages were very close to the chronological age, with an insignificant difference between them. (Zaher *et al*., 2011) Similar results were obtained in our study where we obtained a mean difference of 0.1 years between the estimated age and real age, indicating the reliability of the derived formula. Therefore, it can be concluded that derived regression formulae can be used to estimate the age of an adult population with minimum age difference, using pulp cavity width. This would be a useful alternative or complementary tool for age identification in forensic medicine and archeology.

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