Man In India, 105 (3-4): 2025:: 221-226

A COMPARISON OF TOOTH CORONAL INDICES (TCI) OF PREMOLARS OF THE INDIAN AND AFRO-EUROPEAN POPULATIONS

Asmita Sikdar

Abstract: The teeth being the hardest tissue in the body, are more capable of withstanding the onslaughts of time and natural agencies as compared to other components of the human body thereby, facilitating a better perspective on demography, biological affinities, diet, health and general way of life of populations. The estimation of age from radiographs have not received adequate attention in comparison to attrition-level driven aging techniques. 329 premolars belonging to both Indian males and females of known ages (20-70 years) were chosen. The coronal indices of the pulp cavities were measured from the radiographs (orthopantomograms) following Ikeda et al. (1985; Tooth Coronal Index = Coronal Pulp Chamber Height * 100/ Crown Height). Subsequently, a linear regression model was prepared using the Indian data sets with age as the dependent variable and TCI as the independent variable. This model was tested on a set of teeth not used to prepare the model. The published equations on the Italian and Malawian populations were used on the Indian data sets. The range of indices of the age-groups 20-29, 30-39, 40-49, 50-59, 60-70 were found to be 20.93-46.65, 20.27-39.38, 9.93-27.84, 6.69-27.63 and 6.92-17.93 respectively. There is considerable similarity among the teeth sizes of the Indian and Italian populations. The published equations on Italian and Malawian populations could be used to predict the ages of the Indian population with a variation of ±5 years. Though it is a very preliminary observation on the odontology of two populations still it can be said that people from various parts of the world have more in common than the apparent phenotypic differences.

Keywords: Age-estimation, Pulp cavity, Tooth Coronal Index, Radiographs, Premolars.

Introduction

The main bulk of the tissue in the crown and the roots of the teeth is called circum-pulpal dentine (Hillson, 1996). With the increase in age and attrition, the pulp cavity and the root canal of teeth are gradually infiltrated by regular and irregular secondary dentine. Even after tooth eruption is complete, secondary dentine continues to form along the walls of the pulp chamber. The deposition of the irregular secondary or tertiary (after Kuttler, 1959) dentine takes place in response to exposure of the overlying primary dentine by penetration of the enamel or cementum.

Bodecker (1925) identified the apposition of secondary dentine as being related to chronological age. The dentine transparency and the secondary dentine values showed the highest correlation with age, as the studies of Johanson (1971), Maples (1978), and Metzger *et al*. (1980) have demonstrated.

Asmita Sikdar, Doctoral Fellow, Department of Ancient Indian, History, Culture and Archaeology, Deccan College Post Graduate and Research Institute, Pune. E-mail: sikdarasmita@gmail.com; asmita.sikdar@dcpune.ac.in.

One of the best-known features of ageing is the reduction in size of the pulp chamber, caused by the continual secretion of dentinal matrix by odontoblasts (physiological secondary dentinogenesis) (Solheim, 1992). Dentine is a living tissue containing odontoblasts which form the tooth and which, during a person's lifetime, for both physiological and pathological reasons, deposit layers of secondary dentine which gradually obliterates the pulp chamber (Bodecker, 1925; Vasiliadis *et al*., 1983). The mean rate of increasing dentinal thickness has been found to be 6.5 mm per year for the crown and 10 mm per year for the root (Murray *et al*., 2002).

This paper aims at finding out the odonatological affinities among the Afro-European and Indian populations.

Materials and Methods

X-ray images of adult population were collected from various private clinics in Pune and Kolkata. The images include panoramic x-rays (orthopantomograms/ OPGs, Fig. 1).

Figure 1: OPG of a 26-year-old female

329 premolars belonging to both males and females of known age were chosen. The age group under study was restricted to 20 to 70 years. The coronal indices of the pulp cavities were measured from the radiographs. The formula was obtained by following Ikeda *et al.* (1985; Tooth Coronal Index = Coronal Pulp Chamber Height * 100/Crown Height; Figures 2).

The crown height (CH) was calculated from the cervix to the vertical tip of the highest cusp on the tooth (following Moss *et al.*, 1967) and the coronal pulp cavity height (CPCH) was measured vertically from the cervical line to the tip of the highest pulp horn after Ikeda *et al*. (1985). The OPGs were measured using a

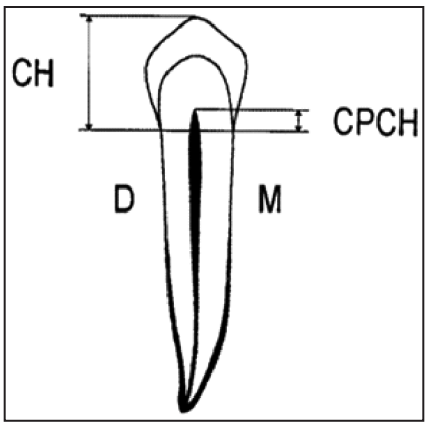

Figure 2: Measurements on Premolar

Digital Vernier Caliper to the nearest 0.01 mm. Each tooth was measured thrice and the mean value of the three measurements were considered for the study. Teeth having histories of medical intervention such as implants, teeth with severe attrition (grades 5-8, after Smith, 1984) and those where the pulp cavities have been distorted by the angle of eruption or radiography itself were not taken into consideration.

Subsequently, a linear regression model was prepared using the Indian data sets with age as the dependent variable (Y) and TCI (X) as the independent variable. This model was tested on a set of Indian teeth not used to prepare the model. The published equations on the Italian (Drusini et al., 1997) and Malawian (Igbigbi and Nyirenda, 2005) populations were used on the Indian data sets.

Results

The following table represents the average of the indices obtained from the Indian population.

Premolars of Indian Population					
Age	*N*	*Mean TCI*	*Median*	*Range of TCI*	*S.D.*
20-29	138	35.46	36.01	20.93-46.65	5.68
30-39	94	28.58	28.71	20.27-39.38	3.97
40-49	36	20.96	22.33	9.93-27.84	4.59
50-59	45	17.02	16.51	6.69-27.63	4.57
60-70	16	11.63	10.56	6.92-17.93	3.46
Total	329				

Table 1: Details of the measurements on the premolars of the Indian Population

The average indices obtained from the calculations were compared with those of the Italian population after Drusini and Drusini *et al.* (1993, 1997). They have been indicated in the table below:

Country	*India*	*Italy*
20-29	35.46	34.60
30-39	28.58	29.81
40-49	20.96	22.45
50-59	17.02	18.56
60-70	11.63	13.11

Table 2: Comparison between the average indices of the Indian and Italian Populations

Since the indices for separate age-groups were not published by the researchers from Malawi (Igbigbi and Nyirenda, 2005), they could not be represented here.

Students' T-Test was applied on the average indices of the Indian males and the females. However, they exhibited no significant differences.

The regression equations obtained from the three respective countries are given below:

Y= 66.89-1.175X-PREMOLARS (MALAWI, Igbigbi Nyirenda, 2005)

Y= 77.617 -1.4636X– PREMOLARS (ITALY, Drusini *et al*., 1997)

Y= 66.983-1.1429X- PREMOLARS (INDIA)

The following table represents through four examples the age prediction of the Indian population using three different equations obtained from three different Old World countries:

Actual age of the India individual	*Age predicted by the author's regression model*	*Age predicted by the model from Malawi (Africa)*	*Age predicted by the model from Italy*
24	23.94	20.70	20.08
44	42.94	37.28	40.73
38	41.98	36.44	39.69
53	55.89	48.57	54.80

Table 3: Age prediction using three different regression models

Conclusion

The tooth pulp cavity indices are correlated with tooth size. A higher index usually speaks of bigger tooth dimensions. Hence, it can be stated that there is considerable similarity among the teeth sizes of the Indian Malawian and Italian populations.

Though it is a very preliminary observation on the odontology of three populations still it can be said that people from various parts of the world have more in common than the apparent phenotypic differences.

The TCI can be further used for aging of the populations through proper regression models.

Declaration of patient consent

The author certifies that she has obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their radiographs and other clinical information to be reported in the academic domain in the form of publication. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity. For certain orthopantomograms, they were obtained from the stock images held by the diagnostic centers or clinics. So, it was not possible to obtain consent of the respective individuals. However, while making the radiographs available, the technicians have removed the names of the patients which will ensure their anonymity.

References

Bodecker, C. F. (1925). A Consideration of Some of the Changes in the Teeth from Young to Old Age. *Dental Cosmos* 67:543–549.

Drusini, A.G. (1993). Age Estimation from Teeth Using Soft X-ray Findings. *Anthropologischer Anzeiger* 51(1):41–46.

Drusini, A. G., Toso, O., and Ranzato. C. (1997). The Coronal Pulp Cavity Index: A Biomarker for Age Determination in Human Adults. *American Journal of Physical Anthropology* 103:353–363.

Hillson, S. (1996). *Dental anthropology*. Cambridge: Cambridge University Press.

Igbigbi, P. S., and Nyirenda, S. K., (2005). Age estimation of Malawian adults from dental radiographs. *West African journal of medicine* 24(4): 329-333.

Ikeda. N., Umetsu, K., Kashimura, S., Suzuki, T. and Oumi, M. (1985). *Estimation of Age from Teeth with their Soft X-ray Findings*, *Japanese Journal of Medicine.* 39(3): 244–250.

Johanson, G. (1971). Age Determination from Human Teeth, *Odontologisk Revy* 22: 1–126.

Kuttler, V. (1959). Classification of Dentine into Primary, Secondary and Tertiary, Oral Surgery. *Oral Medicine, Oral Pathology* 12(8): 906-1001.

Maples, W.R. (1978). An Improved Technique Using Dental Histology for Estimation of Adult Age. *Journal of Forensic Sciences* 23 (4): 764–770.

Metzger, Z., Buchner, A., Gorsky, M. (1980). Gustafson's Method for Age Determination from Teeth: A Modification for the Use of Dentists in Identification Teams. *Journal of Forensic Sciences.* 25(4): 742–749.

Murray, P. E., A. J. Smith. (2002). *Saving pulps—a biological basis. An overview, Primary Dental Care* 9(1): 21-26.

Solheim, T. (1992). Amount of Secondary Dentin as an Indicator of Age. *Scandinavian Journal of Dental Research* 100(4): 193–199.

Vasiliadis, L., Darling, A. I., Levers, B. G. H. (1983). The Amount and Distribution of Sclerotic Human Root Dentine. *Archives of Oral Biology* 28(7): 645-649.