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Pulp -Tooth Ratio For Age Estimation In Forensic Dentistry

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Abstract
In many mass disasters, age estimation is a widely used method for personnel identification. Several methods of age estimation have been studied including bone, which changes as an individual grows. A particular problem for age estimation is that premortem modification may vary from subject to subject and in addition, post-mortem changes and taphonomy are influenced by many factors. Of the various parts of the body used in age estimation, teeth are least effected by the taphonomic process. Previous studies have shown that with advancing age the size of the dental pulp cavity is reduced as a result of secondary dentin deposition, so that the measurement of this reduction can be used as an indicator of age. The present investigation was conducted to examine the possible application of pulp/tooth area ratio by Periapical radiographs as an indicator of age.

Key Words
Pulp, forensic, age, tooth

Introduction

Age estimation of an individual in forensic science is very helpful for personnel identification and to establish mortality patterns in past population. Study of age related changes in dental tissues are often used to estimate the age of an individual. It is a well-established fact that with advancing ages the size of the dental pulp cavity decrases as a result of secondary dentine deposition. The measurement of this reduction in size of the pulp chamber can be used as an indicator of age in forensic and anthropological science.

Several methods of age estimation have been studied based on morphology of human permanent dentition like tooth wear, root dentine transparency, tooth cementum annulation and deposition of secondary dentine.

Previous studies have shown that periapical radiographs may be used for estimation of age[1]. But due to interobserver difference the age calculation may be less accurate when used by different investigators. To reduce inter and intra observer bias, image analysis procedure have been suggested for measurement of morphological parameters in dental tissues[2],[3].

The purpose of the present study was to estimate the age of an individual by determining pulp/tooth ratio of maxillary canines using intraoral periapical radiographs.

Materials and Method

Intra oral periapical radiographs of 30 individuals whovisited our out patient department were taken randomly. All individual were of age group of 20-50 years. Intraoral periapical radiographic images of non-carious healthy maxillary canines were taken with the help of radio-visiuo graphy (RVG). The obtained digital images of canines were processed using a computer-aided drafting program (AutoCAD2000).

Inclusion Criteria

Non-carious healthy maxillary canines were included in this study. Canines were slected in this study since they are mostly present in old age; they are less likely of wear than other anterior teeth and are the single-rooted teeth with the largest pulp area, and thus easy to analyze.

Exclusion Criteria

Multirooted teeth were excluded from the present study because of the difficulty in defining the pulp in each root on a radiograph. Endodontically treated teeth were also excluded because in root filled teeth there are no functioning odontoblast and thus no further secondary dentine formation, which together with the instrumental widening of the pulp, makes the tooth unsuitable for measuring. Apical pathological processes were considered as sign of necrosis and might represent a halt in production of secondary dentine. Such teeth were excluded from the study. Totally impacted teeth remainunexposed to oral cavity and formation of secondary dentine is then a slower process than in functioning teeth. Hence impacted teeth were also excluded.

Twenty points from each tooth outline and ten points from each pulp outline were identified and used to evaluate both tooth and pulp areas. **(Fig. 1)** Following this pulp-tooth ratio was calculated **(Fig. 2)** and age was estimated using

Figure 1

Fig 2

S No	Ratio	Estimated Age	Actual Age
1	0.151	19	23
2	0.150	20	25
3	0.153	18	23
4	0.148	21	25
5	0.131	30	26
6	0.140	25	28
7	0.120	36	30
8	0.135	28	32
9	0.140	25	23
10	0.150	20	26
11	0.133	29	34
12	0.123	34	27
13	0.120	36	32
14	0.146	22	25
16	0.129	31	26
17	0.121	35	30
18	0.159	29	34
19	0.133	29	25
20	0.153	18	23
21	0.095	49	44
22	0.148	21	23
23	0.131	30	25
24	0.112	40	35
25	0.114	39	35
26	0.144	23	27
27	0.131	30	34
28	0.136	27	25
29	0.118	37	29
30	0.133	29	30

regression equation. I.e

Estimated age= 99.937-532.775(x)

Results

Age difference between the estimated age and actual age was +-7 years. Plotting these values on interactive graph it revealed a positive correlation between the estimated age and actual age of the subject. **(Fig. 3)**. Followingregression

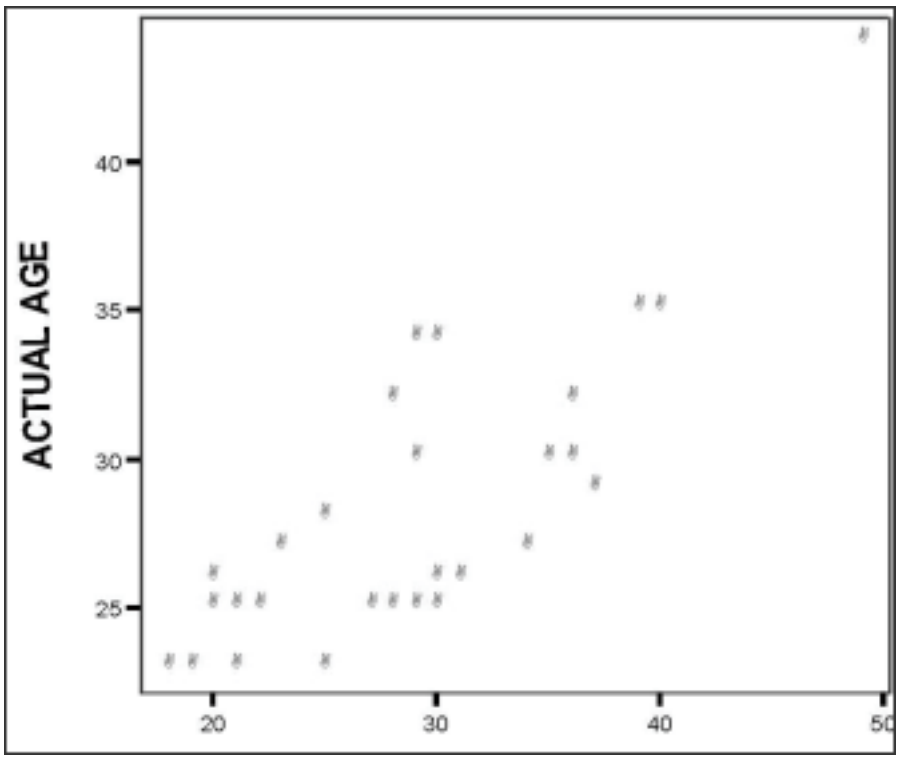

Figure 3

equation was derived from present study.
Age= (13.196+0.528) x estimated age

Using this formula, the age difference between the estimated age and actual age was +- 2 years.

Discussion

Most studies for age estimation have used bone, which changes as an individual grows. Bone modification is visible until subject reaches adulthood, and subsequently in degeneration process[4]. A particular problem for age estimation is that premortem modification may vary from subject to subject and postmortem changes and taphonomy is influcenced by many factors (time, humidity etc). Of various parts of body used in age estimation, teeth are the least effected. Several age estimation methods involving teethstudy tooth modifications including wear[5],[6], root dentine transparency[7],[8], and tooth cementum annulation[9],[10], racemization of aspartic acid[11], [12] and apposition secondary dentine[1],[2]. Wear and apposition of secondary dentine are the currently available nondestructive methods. Tooth wear is influenced by various external factors like- masticatory function, type of food, timing and sequence of tooth eruption, tooth form, position of teeth, thickeness and hardeness of enamel and predisposition to enamel hypoplasia. All these methods require extraction, and preparation of microscopic sections of at least one tooth from each individual. These methods cannot be used in living individual and in cases where it is not acceptable to extract teeth for ethical, religious, cultural or scientific reasons. Howerver, the apposition of secondary dentine is continous, regular process, which is only modified by caries or tooth abrasion. It is a well-established fact that with advancing age the size of the dental pulp cavity decreases as a result of secondary dentine deposition. The measurement of this reduction in size of the pulp chamber can be used as indicator of age in forensic and arthopological science. The need to estimate age in skeletons of adult people is important in forensic and anthropological sciences. Although several parts of the body remains can be used for age estimation, the poor condition of the remains, often prevent their use. For this reason, the teeth are that part of the human body most frequently used for identification and age estimation when skeletal remains are in poor conditions.

Conclsion

The result of present study reveals that canines can be used as morphological variables to predict individual age in the

absence of conventional sources.

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