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RESEARCH ARTICLE

ESTIMATION OF AGE USING LENGTH AND AREA OF DENTINAL TRANSLUCENCY IN NORTH WEST INDIAN POPULATION: A COMAPRITIVE STUDY

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ABSTRACT

Estimation of age is an important part of forensic science. Teeth usually survive destruction and are considered to be better suited for estimating age in badly destructed or unidentifiable corpses. Gustafson's method employs a morpho-histologic approach in estimating age using teeth, Studies on variables suggested by him showed that dentin translucency was best suited for age estimation, asthis method is best suited not only in terms of accuracy but also in terms of simplicity. This study evaluates, whether there is significant correlation between dentin translucency and age. It also assesses the efficacy of two methods in which area (Stereomicroscopic) and length (Digital) of translucent dentine are considered as parameters. Our result show the area wise method to be superior over the length wise method.

INTRODUCTION

The identification of living or deceased persons using unique traits and characteristics of the teeth and jaws is a cornerstone of forensic science. A dead individual can be recognized by extracting a triad of information in the form of the decedent's ethnic origin, gender and age as all humans have an unique identity in life (1). Dental age estimation helps in post mortem identification as well as living individuals in whom the chronological age is under dispute. Teeth are considered as a good source for age estimation as they show gradual physiologic changes in their structure with increasing agesuch as a progressive influx of mineral salts in dentin making it seem more transparent under transmitted light (2,3).

This phenomenon commonly occurs on the root apices and gradually advances towards the coronal dentin with increasing age and this changed dentine is often referred to as 'translucent dentine' or 'transparent dentine'(4,5).

Several structural parameters of teeth are used in the estimation of age (6,7,8). Measurement of area and length of transparent dentin are considered as reliable and reproducible methods for age determination, although much research has not been done to compare which of these two methods has greater accuracy and reliability (9,10,11,12).

This study evaluates the area and length of transparent root dentin and correlates, it with the age of patient. Also the precision in age estimation by using either of these methods is evaluated to prove these methods as a valuable adjunct to forensic odontology.

MATERIAL AND METHODS

Source of data

In the present study seventy freshly single rooted permanent teeth extracted for orthodontic or periodontal reasons were collected between age groups of 30-70 years, with random gender distribution. The complete demographic details of each sample were received and recorded. Twenty samples were kept as control and were used to derive the regression equation for calculating age for the remaining fifty samples.

Method of collection of sample/procedure

Data was collected for all subjects including age, sex, medical and dental histories and other relevant information. Buccolingual sections of the tooth were made up to the thickness of 400 µm by using micromotor and Arkansas stone. The thickness of sections was measured by using digital micrometer.

A method (length wise measurement)

The section was placed on a glass slide and the length of translucency was measured for each section in an apico-coronal direction by using digital caliper and readings were noted (Figure 1).

Figure 1 Length wise reading taken with help of digital calliper for digital method

B method (area wise measurement)

The ground sections used in A method were then stained with 1% methylene blue for 5-7 minutes. In order to measure the area of the root, a horizontal line was drawn with a pencil along the CEJ on the ground section under the stereomicroscope. Over the ground section, transparent graph paper was superimposed and the images were clicked (Figure 2). The numbers of squares were counted in the total root area, and in the translucent apical zone. The ratio of translucent zone to total root area was calculated. Counting was done according to the following guidelines:

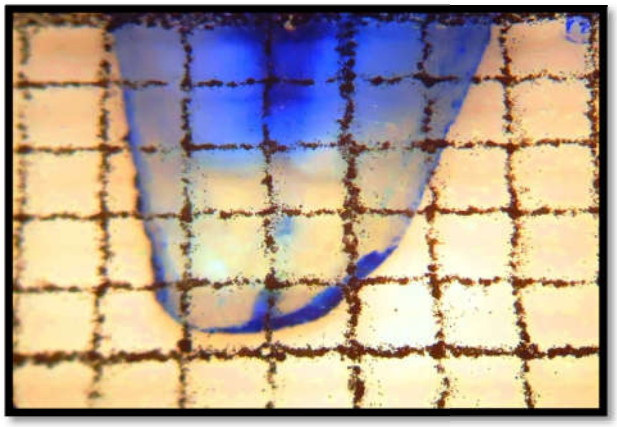


Figure 2 Area wise assessment of translucency under stereomicroscope.

- One completely filled square was taken as 1 mm^2
- More than half filled square was also taken as 1 mm^2
- Less than half filled square was not counted.

Statistical analysis

Length and area of root dentin transparency measured in millimeters were expressed as Mean ± SD and range values. To know the relationship between age and root dentin transparency pearson's correlation coefficient was employed and a regression model was developed. Comparison between different age groups was done by students t-test.

After taking readings of 20 samples the regression formula was derived by using linear regression equation.

Y = 30.71094 + 3.951 X x (digital method)
Y = 35.82715 + 59.93402 X x (stereomicroscopic method)
x = reading taken length or area wise
Y= calculated age either digital or stereomicroscopic

This derived equation was used to calculate the age of the remaining teeth and accuracy of either method was evaluated.

RESULT

The original age of the patients ranged from 30 years to 70 years with a mean age of 48.66 years. The calculated age using digital methods ranged from 31 years to 78 years with a mean age of 52.46 years and using stereomicroscopic method the age ranged from 35 years to 74 years with a mean age of 51.29 years (Table 1).

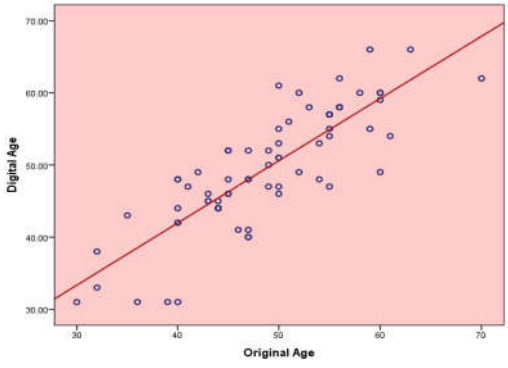
Table 1 Table showing mean and standard deviation of original age, digital and stereomicroscopic age

	N	Mean	Std. Deviation	Minimum	Maximum	Range	Std. Error
Original Age	70	48.66	7.980	30	70	40	.954
Digital Reading	70	4.7300	2.10488	.00	9.10	9.10	.25158
Digital Age	70	52.46	8.45051	31.00	78.00	47.00	1.01003
Stereomicroscopic Reading	70	.21033	.141974	.000	.510	.510	0.17
Stereomicroscopic Age	70	51.29	8.18926	35.00	74.00	39.00	.97880

Out of 70 samples taken number of males and females were 44 and 26 respectively Mean of original age of males and females and mean calculated age for digital and stereomicroscopic specimens is depicted in Table 2. There was no significant difference found in both the genders by using either digital or stereomicroscopic method for age estimation.

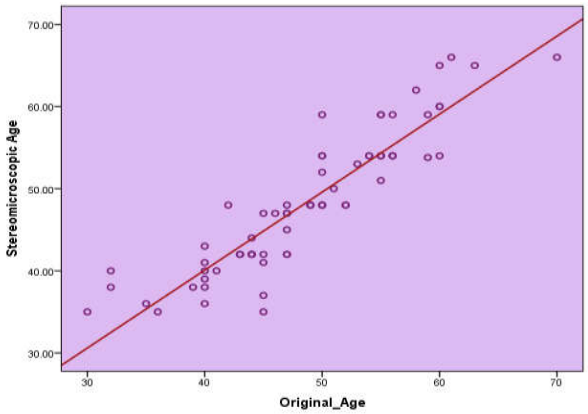
Table 2 Table showing mean and standard deviation of male and females according to original, digital and stereomicroscopic age

		Male	Female	F	P-Value	Interpretation
Original Age	Mean	49.48	47.27	1.256	.266	No Significant difference
	Std. Deviation	7.878	8.112			
Digital Age	Mean	53.1364	51.3077	.859	.357	No Significant difference
	Std. Deviation	8.50606	8.39414			
Stereomicroscopic Age	Mean	52.1818	49.7769	2.087	.153	No Significant difference
	Std. Deviation	8.26951	7.98084			



Graph 1 Graph depicts a correlation graph in between digital age and original age

Correlation in between digital age, stereomicroscopic age with original age is depicted in Graph 1 and Graph 2.



Graph 2 Graph showing the correlation between stereomicroscopic age and original age

The calculated Pearson coefficient for each of the groups was 0.829 in digital method and 0.909 in stereomicroscopic age (Table 3). In combined males and females there was high correlation found between the original age and the calculated age by both the methods with the Stereomicroscopic method being better than the digital method.

three-dimensional phenomenon. To overcome this difficulty, this study not only considered the length as a parameter but also the area of the root dentin as a parameter to correlate with age as was done in few previous studies by Singhal A *et al* (6) and Sabard P *et al* (20). Further to be more accurate in the measurement of translucent dentin, the procedure of dye imbibition was adopted by using 1% methylene blue. The sclerosed dentin remained colourless in this method, normal dentin stained blue, and cementum took up dark blue colour. This could be possible because the translucent dentin is made up of completely mineralized tubules that did not permit the entry of dye into this zone (6).

There is a strong correlation between the translucencies determined by both the above said methods with advancement of age. Our result is in agreement with previous studies done by various authors (18,21). It is interesting to note that there is a gradual and definitive increase in the ratio of this translucency (length, area as a parameter) with that of increase in age. This was particularly prominent when noted in different decades of age (5).

When the two methods are compared and calculated mean indicates that the age is more precisely predicted by stereomicroscopic method.

Table 3 Correlations and Pearson coefficient was calculated for each of the groups

	Correlations Between	Pearson Co-relation	Inter-pretation	P- Value-0.01 level	Inter-Pretation	Conclusion
Combined Male Female	Original Age and Digital Age	.829	Highly Correlated	.000	High Positive Correlation exist	As correlation is high in Stereomicroscopic Age so in both Method it is better
	Original Age and Stereomicroscopic Age	.909	Highly Correlated	.000	High Positive Correlation exist	
Male	Original Age and Digital Age	.808	Highly Correlated	.000	High Positive Correlation exist	As correlation is high in Stereomicroscopic Age so in both Method it is better
	Original Age and Stereomicroscopic Age	.902	Highly Correlated	.000	High Positive Correlation exist	
Female	Original Age and Digital Age	.863	Highly Correlated	.000	High Positive Correlation exist	As correlation is high in Stereomicroscopic Age so in both Method it is better
	Original Age and Stereomicroscopic Age	.920	Highly Correlated	.000	High Positive Correlation exist	

DISCUSSION

Tomes was the first investigator to describe translucent dentine. He wrote that translucency is the result of the consolidation of the dentinal tubules. Czermak held the opinion that translucency arose because of an equalization of the normally different indices of refraction of the tubules and of the calcified dentine matrix (4). This translucency is first noted in the apical part of the tooth because of lesser diameter of dentinal tubules in the root dentin compared to the coronal part (13,14,15,16). Also lesser number of dentinal tubules are noted per unit area in apical part. The increase in translucency is generally considered as a physiological change with aging process as proved by Azaz *et al* (17).

To measure translucency in the specimens two methods were employed, first by measuring the length of translucent dentine extending from the apex using a digital calliper and secondly by measuring the area of translucency under a stereomicroscope. Length of translucent dentin has been studied in intact teeth in order to correlate with the age of the person as done by earlier reports of various authors like Solheim (16), Bang and Ramm(3), Lamedin *et al* (18)Whittaker and Embry (19). As length is only calculated two dimensionally, accuracy may be less as translucency is a

Similar study was done by Sabard P *et al* in which he found length is better than area wise methods (20). These variations may be due to staining technique or regressional formula. As seclerotic dentin increases three dimentionally and the lengthwise method measures translucent dentin only apicocornally, the area wise method consider to be more reliable.

An interesting finding was that the difference in calculated age and original age using digital method was varying largely in samples in the range 45-70 years whereas there was less difference in the 30-45 years age group. On the other hand the stereomicroscopic technique had no such variation and the difference in the original and calculated age was similar in all of the age groups. The possible reason for variation in digital method may be attributed to mechanical error during digital readings and observer variability whereas stereomicroscopic method involves readings under higher magnification so readings are more accurate.

The age group selected for the present study was from 30-70 years. The reason behind this selection of age group is that, sclerosis begins at the root apex after the individual has reached the age of 25 years, so less than 30 years of age will give inaccurate results. Above 70 years of age due to reduction

in the stimulus for formation of sclerotic dentine, underestimation of age may occur (18).

Gender was found to have no significant role with advancing age in the previous studies. Similar results were found in this present study indicating that gender has no significant influence on age estimation when root dentin transparency is considered.

This study comprised of 70 samples, maximum age difference in a single sample using digital method was +/- 11 years and for stereomicroscopic method +/- 9 years. Similar studies found the age limits was found to be within +/- 15 years to +/- 20 years (4,6). Further future research should aim at involving larger sample size, including not only age and gender but also race, culture for the age estimation.

CONCLUSION

The result obtained in this study depict the stereomicroscopic method (area) to be superior over digital method (length) for determination of age, further research is required in this field with large sample size and in different ethnic population.

References

1. Pretty IA, Sweet D. A look at forensic dentistry-Part 1: The role of teeth in the determination of human identity. *British dental journal* 2001; 190:359-66.
2. Rai B, Dhattarwal S. Five markers of changes in teeth: An estimation of age. *The international journal of forensic science* 2005; 5:1-4.
3. Bang G, Ramm E. Determination of age in humans from root dentin transparency. *Acta Odontol Scand* 1970; 28:3-35.
4. Singh S, Venkatapathy R, BalamuraliPD, Charles NSC, Suganya R. Digital approach for measuring dentin translucency in forensic age estimation. *Journal of forensic dental sciences* 2013; 5:47-50.
5. Vasiliadis L, Stavrianos C. Translucent Root Dentine in Relationship to Increasing Age: Review of the Literature. *Research Journal of Biological Sciences* 2011; 6:92-5.
6. Singhal A, Ramesh V, Balamurali PD. A comparative analysis of root dentin transparency with known age. *J Forensic Dent Sci* 2010; 1:18-21.
7. Willems G. A review of the most commonly used dental age estimation techniques. *J Forensic Odontostomatology* 2001;19:9-17.
8. Patel DJ, Kumar S, Sheikh MI. Age estimation in 70 cases by applying gustafson's method on incisors and canines. *Journal of forensic medicine and toxicology* 2007; 24:32-7.
9. Shrigiriwar M, Jadhav V. Age estimation from physiological changes of teeth by gustafson's method. *Medicine science and the law* 2012; 1:1-5.
10. Avon SL. Forensic Odontology: The Roles and Responsibilities of the Dentist. *Can Dent Assoc* 2004; 70:453-8.
11. Pandey A, Singh I, Pandey S, Vidya M. Role and responsibility of dentist as forensic odontologist. JK-Practitioner 2012; 17:80-2.
12. Ali JA, Ali FA. Forensic dentistry in human identification: A review of the literature. *J ClinExp Dent* 2014; 6:e162-7.
13. Ackermann A, Stylen M. A test of the Lamendin method of age estimation in South African canines. *Forensic anthropology* 2012; 2:1-9.
14. Drusini A, Calliari I, Volpe A. Root dentine transparency: age determination of human teeth using computerized densito-metric analysis. *American J PhysAnthro pol* 1991; 1:25-30.
15. Nanci A. Ten Cate's Oral Histology, 8th ed. Elsevier; India 2013:165-206.
16. Solheim T, Kvaal S. Dental root surface structure as an indicator of age. *Journal of Forensic Odontostomatol* 1993;1:9-21.
17. Azaz B, Michaeli Y, Nitzan D. Aging of tissues of the roots of nonfunctional human teeth (impacted canines). *Oral Surg Oral Med Oral Pathol* 1977; 4:572-8.
18. Lamendin G, Baccino E, Humbert JF, Tavernier JC, Nossuctchouk RM, Zerilli A. Simple Technique for Age Estimation in Adult Corpses – The Two Criteria Method. *Journal of Forensic Medicine* 1992; 37:1373-9.
19. Whittaker. Research in forensic odontology. Annals of the Royal College of Surgeons of England 1982; 64:5-9.
20. Sabarad P, Kalburge J. Chronological Age Estimation Using Transparent Root Dentin: A Stereomicroscopic Study. *J Adv Med Dent Sci* 2014; 2:23-32.
21. Foti B, Adalain P, Signoli M, Ardagna Y, Dutour O, Leonetti G. Limits of the Lamendin method in age determination. *Forensic Sci Int* 2001; 122:101-6.

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