Age Estimation Based on Extracted Single Rooted Teeth Using Modified Kvaal's Method in an Indian Population.

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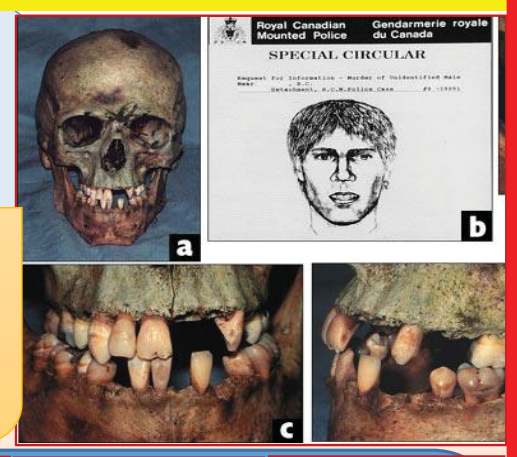
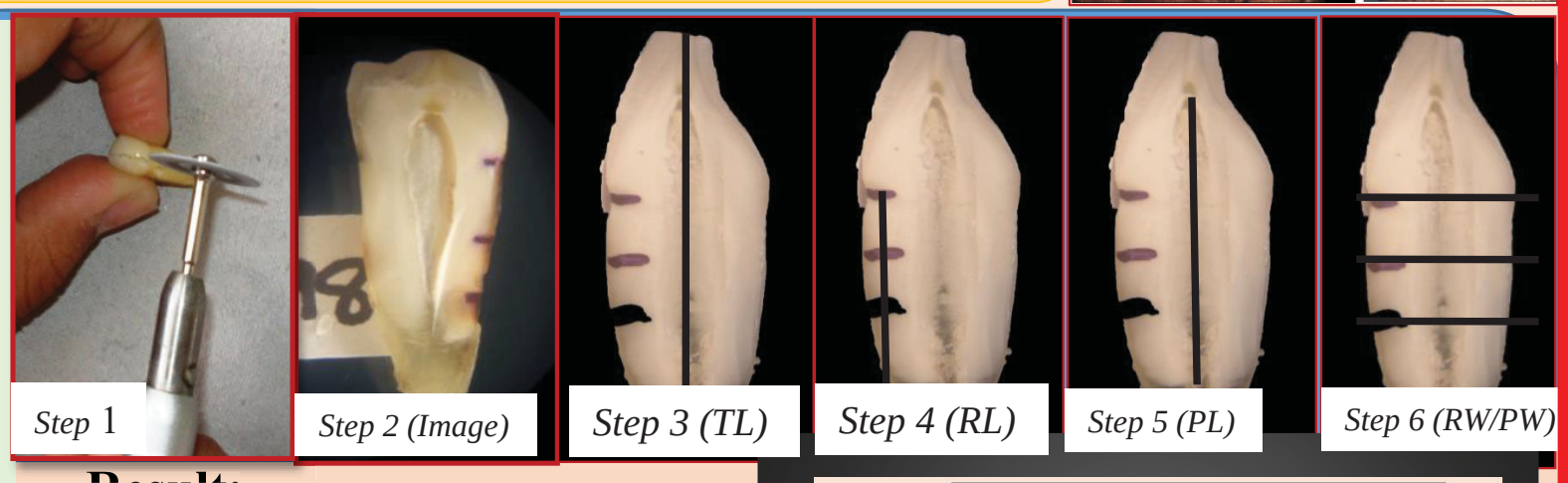
Introduction: Age estimation of skeletal remains is ultimately an art, not a precise science. Kvaal et al. was the first to develop an age estimation formula by using a radiographic method in Norwegian adults. However, radiographic methods have their own errors.



Aim: To estimate the age by using dental morphological parameters measured using a stereomicroscope, by measuring the length and width of the tooth, root, and pulp: i.e. tooth length (TL), root length (RL), pulp length (PL)and root & pulp width at 3 levels. (Parameters considered by Kvaal)

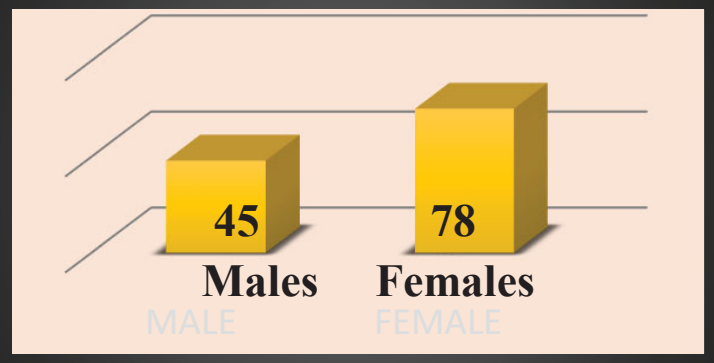
Material & Method:

Only single rooted, non-carious teeth were included. The teeth were cut with an NSK micro motor hand piece. Under a stereomicroscope, images were taken and measurements were done using Adobe Photoshop.



Result:

- Samples collected: 202; Samples included: 123; Age ranged from 15- 85 yrs.
- Data were analysed using ***Stepwise regression analysis.***
- Intraobserver variability test showed high reliability of measurements.



Combined Stepwise Regression Model

SL	Variables	R	P
1	Tooth length (TL)	- 0.048	- (0.599)
2	Root length(RL)	0.019	- (0.836)
3	Pulp length (PL)	-0.4	+ **(<0.001)**
4	Root & pulp width at level A (Rw/Pwa)	0.424	+**(<0.001)**
5	Root & pulp width at level B (Rw/Pwb)	0.466	+**(<0.001)**
6	Root & pulp width at level C (Rw/Pwc)	0.48	+**(<0.001)**

Age	R	SEE
54.684+ 0.634R3- 1.563PL + 1.591R1	***0.552***	***14.168***

Gender-specific Stepwise Regression Model

Gender	Age	R	SEE
Male	***61.124+ 1.883R2-1.640PL***	***0.610***	***12.348***
Female	***56.695 + 1.258R3-1.769PL***	***0.549***	***14.707***

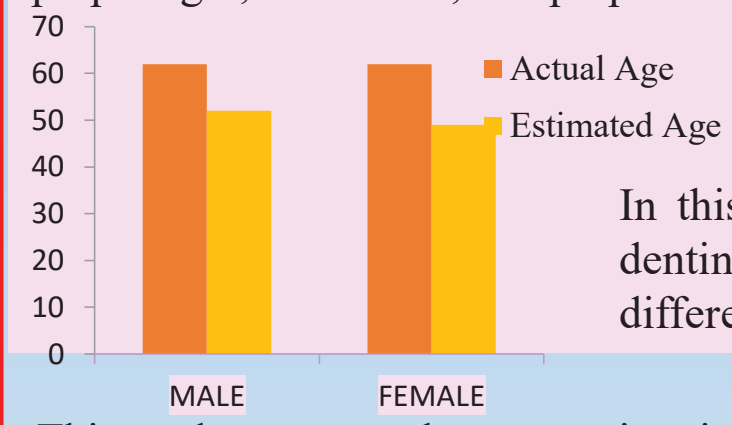
R=regression coefficient, P=level of significance, SEE=Standard error.

In combined analysis, age shows a statistically significant relation with PL, Rw/Pwa, Rw/Pwb, Rw/Pwc levels.

A combined age estimation formula was derived with an SEE of 14.16.

In the gender-specific regression analysis, male subjects' formula demonstrated a lower SEE of 12.38 compared to females.

Discussion: With aging, the pulp cavity gradually becomes smaller because of dentin deposition. Secondary dentin deposition is a well established criteria in age determination since Gustafson's study. Our results illustrate the significance of pulp length, root width, and pulp width in age estimation.



$$\text{Age} \propto \frac{\text{R Width}}{\text{Pulp Width; Length}}$$

In this study, males showed better age prediction, as there is a difference in secondary dentin deposition between the sexes. Moreover, the pattern of the deposition varies among different groups of teeth; hence, tooth-specific formulae should be derived.

Conclusion:

- This study suggests that age estimation can be done by using a stereomicroscope to consider pulp length and root and pulp width parameters. However, further studies with larger sample sizes and an equal distribution of age and gender should be considered in order to validate the accuracy of the present results.