Age Estimation through Root Maturation of Right Mandibular 3rd Molar by Using Improved Gleiser and Hunt Technique

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Original Research Article

ABSTRACT

Background: Determination of sex, age, race, and stature are the first steps in firmly identifying a cadaver. As a result, assessing age is important, and the estimation should be as authentic as possible. Age determination is also crucial at this stage of human remains discovered during archaeology because it enables us to evaluate ancient population mortality rates. The dental age of an individual is crucial in determining one's age. It is often combined with skeletal age to enhance the accuracy of age estimation. Dental radiological imaging has been commonly used in age estimation as a noninvasive technology. On radiographs, determining age-related changes such as crown and root growth.
Materials and methods: The study samples were retrieved from DIAS of Saveetha Dental College and Hospitals between the retrospective months from November 2020 to February 2021. The study included 200 OPGs (100 females and 100 boys) ranging in age from 10 to 19.9 years old. They were evaluated by using Modified Gleiser and Hunt method.

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Results: The study reveals that the standard estimate error is low for the selected population which implies that the selected OPGs for the study and scoring of root maturation is proper, though there is no statistical significance.
Conclusion: By using this parameter involving the root maturation of 48 by radiographic view, the Forensic Odontologist can determine age which is the backbone of medicolegal cases.

1. INTRODUCTION

The dental age of an individual is crucial in determining one's age. It is often combined with skeletal age which helps in enhancing the accurate evaluation of age estimation. Dental radiological imaging has been commonly used in age estimation as a noninvasive technology. On radiographs, determining age-related changes such as crown and root growth [1]. A radiologically observed degree of third molar development and data registered is used to model age estimation methods based on third molar growth. The mineralisation of a cusp tip marks the beginning of third molar growth and ends with the closure of the apices at the termination of root growth. Intermediate tooth development can be evaluated at various stages of human growth [2].

Over the previous era, the quantity of unknown corpses and human remnants, as well as incidents missing age documentary evidence and thus demanding age determination, has improved. This precludes age determination, not only to differentiate between infantile and grown-up roles in illegal law cases, but also to determine age chronology. Similarly, since many teeth are developing and mineralizing at the same time, dental age can be determined with greater precision in young children. The only teeth still in growth between the ages of 10 and 19.9 years are second and third molars, making them extremely valuable for determining dental age [3]. The main goal of the study is to estimate the age of an individual by evaluating the root maturation in the right side of the mandible (48) by using a modified Gleiser and hunt method.

2. MATERIALS AND METHODS

The study samples were retrieved from DIAS of Saveetha Dental College and Hospitals between the retrospective months from November 2020 to February 2021. The study sample involved of 200 OPG's (100 females and 100 males) of phase ranged from 10 to 19.9 years. They were evaluated in Table 1.

On the basis of calcification of permanent teeth, panoramic radiographs (digital) of all individuals were used to determine maturation stage of tooth 48 (right mandibular arch). For easier identification, the staging was updated and provided conferring to the Gleiser and Hunt method of 17 presentation scheme, in which routine labelling nomenclature was transformed from Roman (stages I to xv) to Numericals (stages 1 to 17), elaborated in Fig. 1. The univariate regression analysis for 48 tooth staging for females and males is summarised in Table 3 and Table 4 respectively.

Table 1. Sample distribution in different age groups

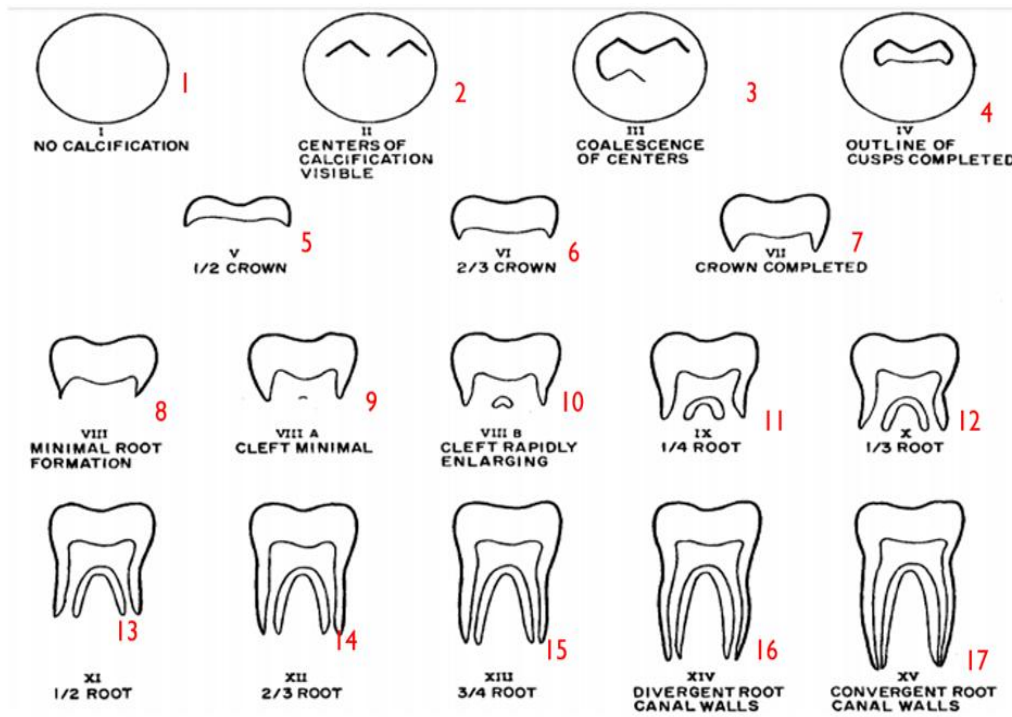| GROUPS	AGE(years)	MALE	FEMALE
1	10 to 10.9	10	10
2	11 to 11.9	10	10
3	12 to 12.9	10	10
4	13 to 13.9	10	10
5	14 to 14.9	10	10
6	15 to 15.9	10	10
7	16 to 16.9	10	10
8	17 to 17.9	10	10
9	18 to 18.9	10	10
10	19 to 19.9	10	10
TOTAL		100	100

Fig. 1. The modified 17 stages chart for gleiser and hunt scoring

3. RESULTS

Table 2. Group statistics

Age (Years)	Gender	N	Std. Deviation	Std. Estimation Error	P value
10 to 10.9	F	10	3.59629	1.13725	0.310
	M	10	2.76687	.87496	
11 to 11.9	F	10	3.63471	1.14940	0.192
	M	10	.84984	.26874	
12 to 12.9	F	10	2.33095	.73711	0.688
	M	10	2.29129	.76376	
13 to 13.9	F	10	2.26323	.71570	0.684
	M	10	2.05751	0.65064	
14 to 14.9	F	10	1.25167	0.39581	0.375
	M	10	2.46080	0.7817	
15 to 15.9	F	10	3.3266	1.05198	0.738
	M	10	5.60654	1.77294	
16 to 16.9	F	10	3.40588	1.07703	0.637
	M	10	2.00000	0.63246	
17 to 17.9	F	10	5.03433	1.59199	0.304
	M	10	1.91195	0.60461	
18 to 18.9	F	10	5.87367	1.85742	0.149
	M	10	3.64539	1.15277	
19 to 19.9	F	10	5.14350	1.62652	0.179
	M	10	3.69534	1.16857	

Table 3. The univariate regression analysis for the age estimation for females using tooth 48

Univariate Regression	Intercept	Regression coefficient	F-Ratio	P value	T value	P value	R2
48 tooth staging	12.521	0.282	20.991	.000c	4.582	.000	0.176

Note: The regression equation is good, if R2 value is nearer to 1.

Age= 12.521+0.282 × tooth staging±1.43

Table 4 . The univariate regression analysis for the age estimation for males using tooth 48 as follows

Univariate Regression	Intercept	Regression coefficient	F-Ratio	P value	T value	P value	R2
48 tooth staging	10.633	0.404	59.655	.000c	7.724	.000	0.381

Note: If R2 value is nearer to 1, then that regression equation is good.
Age =10.633+0.404×tooth staging±1.31

4. DISCUSSION

The first steps in positively identifying a cadaver are determining its gender, age, race, and stature.. As a result, assessing age is important, and the estimation should be as authentic as possible. Age determination is also crucial at this stage of human remains discovered during archeology because it enables us to evaluate ancient population mortality rates. These may hold information about an individual's birth, existence, and demise in the past. Conventional means for ageing process adult cadavers are, regrettably, highly subjective. If the body is in good condition, the apparent age can be determined visually; however, if the remains have deteriorated in some way, traditional morphological or histological aging process methods on dental elements must be used [4].

The present study is first of its kind to evaluate the root maturation of tooth 48. The standard deviation for females is ±1.43 and for males is ±1.31. The study reveals that the standard estimate error is low for the selected population which implies that the selected OPGs for the study and scoring of root maturation is proper, though there is no statistical significance. The standard estimation error is as low as 0.26 in male belonging to age group 11 to 11.9 while in females it is as low as 0.39 in age group 14 to 14.9. The low standard estimation error values shows significance that the sample size is precise for the above mentioned age groups.

Age estimation through tooth progress has been used for a long period; after all, dental growth is an accurate indicator of chronological age that appears to be self sufficient of exogenous factors. Univariate regression formula is fabricated for females and males separately which might help in estimating the age of an unknown individual. Medical evidence on age, while not an eyewitness, is a point of view based on the scientific reasoning and is therefore needed by a courtroom in verifying the person's age engaged in criminal or civil affairs prior to the characterization of the crime or imposition of its punishment.. In the past, forensic scientists used a combination of quantitative and subjective factors to determine a person's age [5].

Age estimation by alveolar procedures has its own deficiencies, especially during juvenile and adolescent years when the third and second molars are the only varying dental factors remaining. There is a lot of variability in location, morphology, and time of formation [3]. Kohler et al.(1994), did a full assessment of all enduring third molars' growth and maturity. The Gleiser and Hunt (1955) method of grading first molars has been revised. There are ten grading levels in total, with 3 crown formation stages and seven root formation stages.Using logistic regression formulas, this technique helps in achieving high precision of juvenile or adult (/>18 years), and it has considered to be more important to age of around 20 years [6].

The third molar development model is thought to be more reliable, particularly with regard to estimating dental age across ethnic groups. The eruption or emergence of the third molar, on the other hand, has been claimed to be most vulnerable to osseous sequence as well as local factors such as poor spacing in the retro-molar region, between the distal of the second molar and the anterior border of the ascending ramus of the mandible. In most nations, the age of criminal liability is 18 years, as a result, the third molar serves as a legal foundation for determining a human's chronological age based on the dental developmental age boundary.. However, based on the techniques used, estimation error can occur to some degree due to its high variability [7]. The limitation of the present study is limited sample size which can be increased along with different age groups to determine the exact reliability of the study.

5. CONCLUSION

Gleiser and Hunt observed a more efficient measure of dental and sequential age

determination of a immature and young person aged 10 to 20 years by instituting the radiological method of permanent mandibular second and third molars (left side). The goal of third molar tooth eruption and achievement is to develop between the ages of 10 and 15 years, which falls inside the adolescent period. So, the Forensic Odontologist can determine age, which is the backbone of medicolegal cases, by engaging the root maturation of 48 by radiographic view.

CONSENT

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Shi G-F, Liu R-J, Fan L-H, Bian S-Z, Zhu G-Y. [Age estimation by dental radiological imaging]. Fa Yi Xue Za Zhi. 2008 Dec;24(6):448–52.

2. Thevissen PW, Fieuws S, Willems G. Third molar development: measurements versus scores as age predictor. Arch Oral Biol. 2011 Oct;56(10):1035–40.

3. Arthanari A, Doggalli N, Vidhya A, Rudraswamy S. Age Estimation from Second & Third Molar by Modified Gleiser and Hunt Method: A Retrospective Study. Indian J Forensic Med Toxicol. 2020; 14(4).

4. Waite ER, Collins MJ, Ritz-Timme S, Schutz HW, Cattaneo C, Borrman HI. A review of the methodological aspects of aspartic acid racemization analysis for use in forensic science. Forensic Sci Int. 1999 Jul 26;103(2):113–24.

5. Balaraj BM, Nithin MD. Determination of adolescent ages 14-16 years by radiological study of permanent mandibular second molars. J Forensic Leg Med. 2010 Aug;17(6):329–32.

6. Köhler S, Schmelzle R, Loitz C, Püschel K. Development of wisdom teeth as a criterion of age determination. Ann Anat. 1994 Aug;176(4):339–45.

7. Mohd Yusof MYP, Cauwels R, Deschepper E, Martens L. Application of third molar development and eruption models in estimating dental age in Malay sub-adults. J Forensic Leg Med. 2015 Aug;34:40–4.