Original Study (Short Study)

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Age Estimation from Second & Third Molar by Modified Gleiser and Hunt Method : A Retrospective Study

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Abstract

The aim of the present investigation, which is a modification of previous study done by Gleiser and Hunt(1955). The study was conducted to determine juvenile and adolescent ages of age group 10 to 19.9yrs, in South Indian Population. The evaluated materials consisted of 200 OPG'S. In this Mandibular Left 37 & 38 is the most variable tooth in the permanent dentition, which was the only data used for age estimation. The Standard deviation for Male 37 staging is ± 2.15years and for 38 staging is ± 1.29 years. And, the Standard deviation for Female 37 staging is ± 2.58 years and in 38 staging is ±2.24 years. The combination of Male tooth number 37 & 38 staging is revealing the good results with the standard deviation of ± 1.23 years and the combination of Female tooth number 37 & 38 revealing the average results of ±2.18 years. While comparing to both Male and Female tooth number staging Male is showing more accurate than females in root maturation.

Key Words: *2nd and 3rd (Left Side), Apical Closure, Gleiser and Hunt staging.*

Introduction

The last decade number of unidentified cadavers and human remains as well as number of cases lacking age documentation and therefore requiring age determination has increased. This requires age calculation, not only for differentiating the juvenile from the adult status in criminal law cases, but also for chronological age[1,2,3]. The determination of the chronological age within the age span of 10-20 years of age still remains a problem[4,5,6,7,8,9].

Similarly, dental age can be assessed among young children with greater accuracy because many teeth are undergoing development and mineralization simultaneously [10, 11, 12, 13,14]. The age span of 10 to 16 years and 17 to 19.9 years of age the second and third molar are the only teeth still in development and thereby very important for dental age calculation[3,15]. In addition, the use of wisdom teeth in age estimation has been questioned in literature [3,15,20]. Before drawing this conclusion, one has take into consideration multiple misleading factors such as small sample sized studies [3,16,17,19] case reports [10,21], improper statistics [3,18] and mixed samples of different ethnic origin [17,22,23]. Recently, Schmeling et al. published most suitable procedures that currently available for age estimation in criminal procedures, being physical examination with anthropometric measurements, radiographic examination of left hand in case of dexterity and radiographic study of dentition [24].

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Materials and Method

The study sample consisted of 200 OPG's (100 males and 100 females) of age ranging from 10 to 19.9 years with known date of birth divided into ten groups accordingly (Table 1). The radiographs were collected from archive of Department OMR, JSS Dental College and Hospital, Mysore, Karnataka, which were taken with PROMAX digital Planmeca Machine.

DURATION OF THE STUDY: MARCH 2019 TO MAY 2019

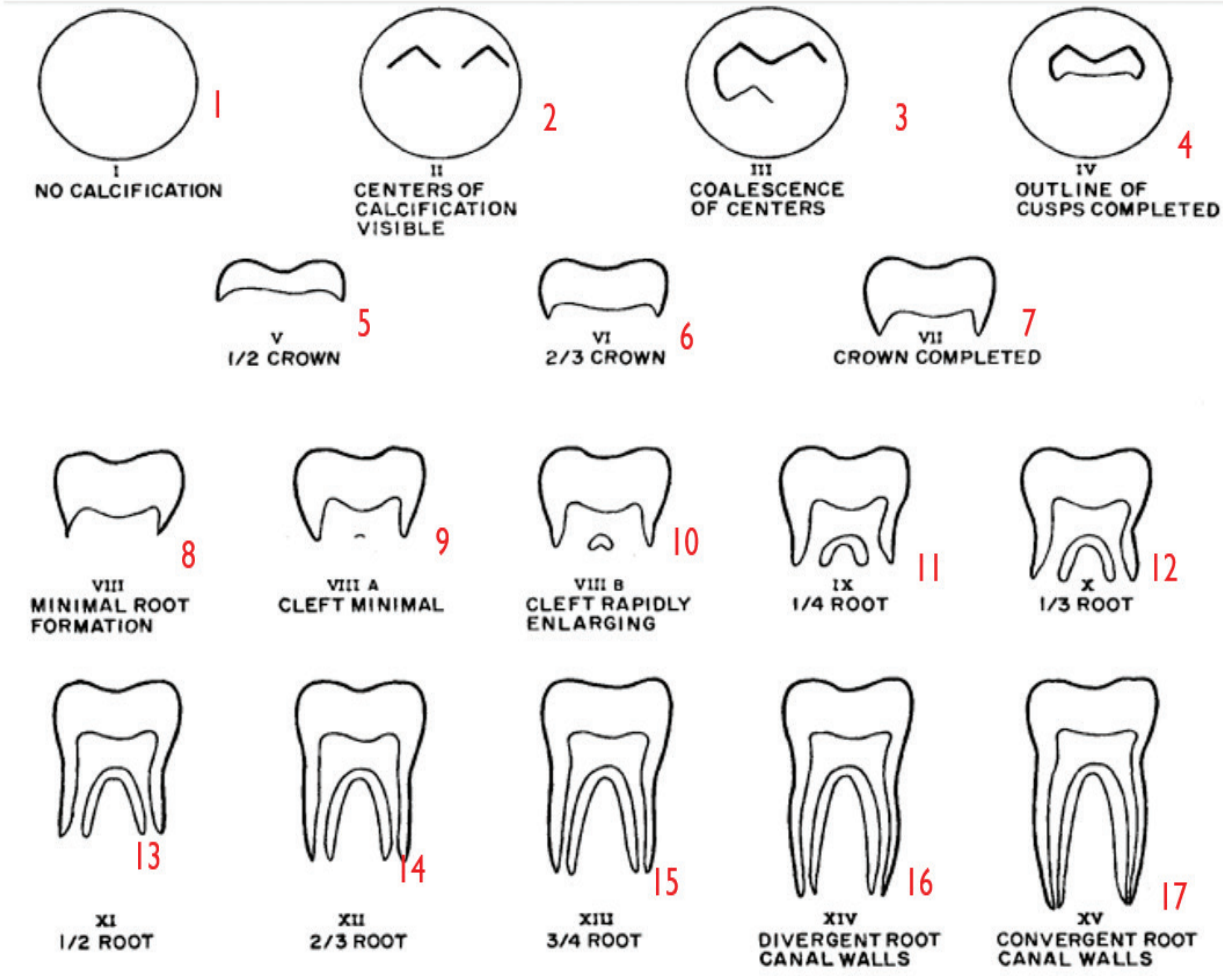
ASSESMENT OF DENTAL AGE USING GLEISER AND HUNT METHOD:

Chronological age (actual age) of individual was calculated by subtracting the birth date from date on which the radiographs were exposed for that particular individual. Digital panoramic radiographs {OPG's} of all individuals were used to assess the status of maturation on basis of calcification of permanent teeth (left side mandibular arch), (37 and 38). This present study Staging were modified and given according to Gleiser and Hunt method of 17 staging system in which the labeling nomenclature were changed from Roman (stages I to xv) to Numericals (Stages 1 to 17) [28] for easy identification.(Fig: 1)

TABLE 1: Sample Distribution

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

Figure: Modified the 17 stages illustrated below



All the mean dental age values from 37 and 38 obtained were averaged was taken to obtain overall mean age separately for 37 and 38 was done shown (Table 2). Multiple regression analysis where obtain for dental age calculation which shown (Table 3, 4, 5).

Results

Table 2: GROUP STATISTICS- T test

AGE GROUP (years)	TOOTH NUMBER STAGING	SEX	N	MEAN	SD	SDE	P VALUE
10 – 10.9	Tooth no 37 staging	Male	10	11.7000	4.62000	1.46097	
		Female	10	12.8000	3.45768	1.09341	0.554
	Tooth no 38 staging	Male	10	6.3000	2.11082	.66750	0.033*
		Female	10	3.4000	3.37310	1.06667	
11 – 11.9	Tooth no 37 staging	Male	10	10.6000	1.71270	.54160	
		Female	10	12.8000	1.54919	.48990	0.007*
	Tooth no 38 staging	Male	10	3.3000	1.49443	.47258	
		Female	10	4.1000	3.69534	1.16857	0.534
12 – 12.9	Tooth no 37 staging	Male	10	14.4000	1.26491	.40000	
		Female	10	14.6000	1.89737	.60000	0.785
	Tooth no 38 staging	Male	10	7.0000	.66667	.21082	1.000
		Female	10	7.0000	1.88562	.59628	
13 – 13.9	Tooth no 37 staging	Male	10	14.8000	1.54919	.48990	
		Female	10	.96609	.96609	.30551	0.013*
	Tooth no 38 staging	Male	10	.51640	.51640	.16330	0.242
		Female	10	2.83039	2.83039	.89505	
14 – 14.9	Tooth no 37 staging	Male	10	16.4000	.51640	.16330	
		Female	10	16.8000	.42164	.13333	0.074
	Tooth no 38 staging	Male	10	7.6000	2.54733	.80554	0.223
		Female	10	8.7000	1.05935	.33500	
15 – 15.9	Tooth no 37 staging	Male	10	16.8000	.42164	.13333	
		Female	10	16.8000	.42164	.13333	1.000
	Tooth no 38 staging	Male	10	11.0000	2.44949	.77460	0.436
		Female	10	10.1000	2.60128	.82260	
16 – 16.9	Tooth no 37 staging	Male	10	16.8000	.42164	.13333	
		Female	10	16.4000	.69921	.22111	0.139
	Tooth no 38 staging	Male	10	14.5000	2.22361	.70317	0.133
		Female	10	12.2000	4.04969	1.28062	
17 – 17.9	Tooth no 37 staging	Male	10	17.0000	.00000a	.00000	
		Female	10	17.0000	.00000a	.00000	
	Tooth no 38 staging	Male	10	16.2000	.78881	.24944	0.077
		Female	10	14.5000	2.75882	.87242	
18 – 18.9	Tooth no 37 staging	Male	10	16.9000	.31623	.10000	
		Female	10	16.9000	.31623	.10000	1.000
	Tooth no 38 staging	Male	10	15.7000	1.63639	.51747	0.641
		Female	10	16.0000	1.15470	.36515	
19 – 19.9	Tooth no 37 staging	Male	10	16.9000	.31623	.10000	
		Female	10	17.0000	.00000	00000	0.331
	Tooth no 38 staging	Male	10	16.5000	.00000	.16667	0.176
		Female	10	14.1000	5.36346	1.69607	

The group statistics reveals that statistically significant results are seen in the age groups:

· 11-11.9 years (P value = 0.007) and 13-13.9 years (P value = 0.013) for tooth number 37.

· 10-10.9 years (P value = 0.033) for tooth number 38.

The standard deviation for tooth number 37 is the lowest (0.00) in the age groups:

· 17-17.9 years for males

· 17-17.9 and 19-19.9 for females.

The standard deviation for tooth number 38 is the lowest in the age groups:

· 19-19.9 years for males (0.00)

· 14-14.9 years for females (1.05 years).

Table 3: The univariate regression Analysis 37 and 38 is as follows: (Male)

Univariate Regression (Male)	Intercept	Regression Coefficient	F- Ratio	P value	t value	P value	R2
Tooth_37_staging	3.777	0.731	87.471	.000c	9.353	.000	0.353
Tooth 38_staging	9.191	0.542	413.906	.000c	29.717	.000	0.809

Note: If R^2 value is nearer to 1, then that regression equation is good.

***Formula 1 (37)*: Age = 3.777 + 0.731 (37 stage); SD ± 2.15years**

***Formula 2 (38)*: Age = 9.191 + 0.542 (38 stage); SD ± 1.29 years**

· Therefore, in males Formula 1 ($R^2 = 0.353$) is preferred to estimate the age.

Table 4: The univariate regression Analysis 37 and 38 is as follows: (Female)

Univariate Regression (Female)	Intercept	Regression Coefficient	F- Ratio	P value	t value	P value	R2
Tooth_37_staging	.590	.899	53.466	.000c	7.312	.000	0.472
Tooth 38 staging	10.517	.439	102.508	.000c	10.125	.000	0.511

Note: If R^2 value is nearer to 1, then that regression equation is good.

***Formula 1 (37)*: Age = 0.590 + 0.899 (37 stage); SD ± 2.58 years**

***Formula 2 (38)*: Age = 10.517 + 0.439 (38 stage); SD ± 2.24 years**

· Therefore, in females Formula 1 ($R^2 = 0.472$) is preferred to estimate the age.

Table 5: Multivariate Regression Analysis (Female & Male)

Multivariate Regression (Female)	Regression Coefficients	F-ratio	P value	t-value	P values	R2
Intercept = 5.944 Tooth 37 staging Tooth 38 staging	 0.346 0.348	 37.344 37.344	 0.000 0.000	 2.543 6.302	 0.013 0.000	0.542
Multivariate Regression (Male)	Regression Coefficients	F-ratio	P value	t-value	P values	R2
Intercept= 6.953 (Constant) Tooth37 staging Tooth38 staging	 0.197 0.470	 234.400 37.344	 0.000 0.000	 3.764 14.211	 0.001 0.000	0.829

***Formula Female*: Age = 5.944 + 0.346 (37 stage) + 0.348 (38 stage); SD ±2.18 years**

***Formula Male*: Age = 6.953 + 0.197 (37 stage) + 0.470 (38 stage); SD ± 1.23 years**

Discussion

In this present study it was observed that there was a difference between Male and Female root maturation in relation to 38 and combination of 37 & 38 (nearly 1.2yrs variation). So, males are showing more accurate than females in root maturation. There is significant correlation b/w chronological age (actual age) and dental age(estimated age) in males R^2 value is 0.829 by using Multivariate Regression(37 & 38). 38 Univariate Regression of R^2 value for male is nearer to 0.809.

The Standard deviation for Male 37 staging is ± 2.15years and for 38 staging is ± 1.29 years. And, the Standard deviation for Female 37 staging is ± 2.58 years and in 38 staging is ±2.24 years. The combination of Male tooth number 37 & 38 staging is revealing the good results with the standard deviation of ± 1.23 years and the combination of Female tooth number 37 & 38 revealing the average results of ±2.18 years. While comparing to both Male and Female tooth number staging Male is showing more accurate than females in root maturation.

Age estimation by means of tooth development has been used over, long period of time, after all tooth development is an accurate measure of chronological age that seems to be independent of exogenic factor[10,17,25]. However, age estimation based on dental methods has shortcomings, especially during juvenile and adolescence when the second and third molar is the only variable dental indicator left. Indeed a great variation in position, morphology and time of formation exists.

The literature studies dealing with age estimation by using third molars as age predictors are scarce. In one study, Hispanic origin were evaluated [11], but in most of the studies subjects from different racial origin were screened [15,22].

Kohler et al. (1994), This method is based on evaluation of development and maturation of all permanent third molars. It has modified the Gleiser and Hunt (1955) method of grading first molar. It consists of ten stage of grading i.e. 3 stages of crown formation and 7 stages of root formation. It has given more priority to age of about 20 years & method enables good accuracy of juvenile or adult (</>18 years) using logistic regression formulas. It can also be used for the age estimation in 14-22 years old subjects.[26]

Mincer et al. (1993), Studied third molar development radiographically to use it as an estimator of chronological age in children and adolescents (age range 14-24 years). Development of maxillary third molar was found to be more foremost than mandibular third molars and also root formation was earlier than females used for predicting an individual is </>18 years using regression formulas.[15]

Balaraj and Nithin (2010), conducted radiological study of closure of apical foramen of both permanent mandibular second molars for determination of adolescents ages 14 – 16 years. Their study makes use of Demirjian method utilizing the description of dental formation stages of complete root formation and apical closure.[27]

Conclusion:

To obtain multiple regression formula of dental age calculation with the chronological age as the independent variable and second and third molar developmental stages as dependent variables and to calculate probability for an individual to be older than 18 years in case of full second and third molars development. Gleiser and Hunt method found much more reliable method of dental and chronological age determination of an juvenile and adolescent ages 10 to 20years using radiological method of permanent mandibular second and third molar (left side). The purpose behind the second and third molar tooth eruption and completion is its development during the age of 10 to 15years, which is lying within period of adolescent age. So, by using these two parameters (radiographic view of root maturation), the Forensic Odontologist can determine the importants behind the medicolegal cases.

Ethical Clearance: Taken From Jssdch

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References

1. S. Ritz-Timme, C. Cattaneo, M.J. Collins, E.R. Waite, H.W. Schu¨ tz, H.J. Kaatsch, H.I. Borrman, Age estimation: the state of the art in relation to the specific demands of forensic practice, Int. J. Legal Med. 113 (2000) 129–136.
2. G. Willems, A review of the most commonly used dental age estimation techniques, J. Forensic Odontostomatol. 19 (2001) 9–17.
3. J. Thorson, U. Hagg, The accuracy and precision of the third mandibular molar as an indicator of chronological age, Swed. Dent. J. 15 (1991) 15–22.
4. H.M. Liversidge, B. Herdeg, F.W. Ro¨sing, Dental age estimation of non-adults. A review of methods and principals, in: K.W. Alt, F.W. Ro¨sing, M. Teschler-Nicola (Eds.), Dental Anthropology. Fundamentals, Limits and Prospects, Springer, Vienna, 1998, pp. 420–442.
5. F.W. Ro¨sing, S.I. Kvaal, Dental age in adults—a review of estimation methods, in: K.W. Alt, F.W. Ro¨sing, M. Teschler- Nicola (Eds.), Dental Anthropology. Fundamentals, Limits and Prospects, Springer, Vienna, 1998, pp. 443–468.
6. W.W. Greulich, S.I. Pyle, Radiographic atlas of skeletal development of the hand and wrist, Stanford University Press, Stanford, 1959.
7. K.F. Kreitner, F.J. Schweden, T. Riepert, B. Nafe, M. Thelen, Bone age determination based on the study of the medial extremity of the clavicle, Eur. Radiol. 8 (1998) 1116–1122.
8. J.M. Tanner, R.H. Whitehouse, W.A. Marshall, M.J.R. Healy, H. Goldstein, Assessment of Skeletal Maturity and Prediction of Adult Height (TW2 Method), Academic Press, London,1975.
9. J.M. Tanner, R.H. Whitehouse, W.A. Marshall, M.J.R. Healy, H. Goldstein, Assessment of Skeletal Maturity and Prediction of Adult Height (TW2 Method), Academic Press, London,1975.
10. P. Nambiar, H. Jaacob, R. Menon, Third molars in the establishment of adult status—a case report, J. Forensic Odontostomatol. 14 (1996) 30–33.
11. A.C. Solari, K. Abramovitch, The accuracy and precision of third molar development as an indicator of chronological age in Hispanics, J. Forensic Sci. 47 (2002) 531–535.
12. A. Demirjian, H. Goldstein, J.M. Tanner, A new system of dental age assessment, Hum. Biol. 45 (1973) 211–227.
13. C.J. Nortje, A.M.P. Harris, Maxillo-Facial radiology in forensic dentistry: a review, J. Forensic

Odonto-Stomatol. 1 (1986) 29–38.

14. A. Demirjian, H. Goldstein, New systems for dental maturity based on seven and four teeth, Ann. Hum. Biol. 3 (1976) 411–421.
15. H.H. Mincer, E.F. Harris, H.E. Berryman, The A.B.F.O.study of third molar development and its use as an estimator of chronological age, J. Forensic Sci. 38 (1993) 379–390.
16. L. Kullman, G. Johanson, L. Akesson, Root development of the lower third molar its relation to chronological age, Swed. Dent. J. 16 (1992) 161–167.
17. L. Kullman, Accuracy of two dental and one skeletal age estimation method in Swedish adolescents, Forensic Sci. Int. 75 (1995) 225–236.
18. U. Ha¨gg, L. Matsson, Dental maturity as an indicator of chronological age: the accuracy and precision of three methods, Eur. J. Orthod. 7 (1985) 25–34.
19. M.J. Harris, J. Nortje, The mesial root of the third mandibular molar. A possible indicator of age, J. Forensic Odonto- Stomatol. 2 (1984) 39–43.
20. I. Robetti, M. Iorio, M. Dalle Molle, Orthopantomography and the determination of majority age, Panminerva Med. 35 (1993) 170–172.
21. N. Phrabhakaran, Age estimation using third molar development, Malasyian J. Pathol. 17 (1995) 31–34.
22. B. Willershausen, N. Loffler, R. Schulze, Analysis of 1202 orthopantomograms to evaluate the potential of forensic age determination based on third molar developmental stages, Eur. J. Med. Res. 6 (2001) 377–384.
23. A. Schmeling, W. Reisinger, D. Loreck, K. Vendura, W. Markus, G. Geserick, Effects of ethnicity on skeletal maturation: consequences for forensic age estimations, Int. J. Legal Med. 113 (2000) 253–258.
24. A. Schmeling, A. Olze, W. Reisinger, G. Geserick, Age estimation of living people undergoing criminal procedures, Lancet 358 (2000) 89–90.
25. B. Melsen, A. Wenzel, T. Miletic, J. Andreasen, P.L. Vagn- Hansen, S. Terp, Dental and skeletal maturity in adoptive children: assessments at arrival and after one year in the admitting country, Ann. Hum. Biol. 13 (1986) 153–159.
26. Köhler S, Schmelzle R, Loitz C, Püschel K. Development of wisdom teeth as a criterion of age determination. 01 Aug 1994, 176(4):339-345.
27. 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. doi: 10.1016/j.jflm.2010.05.003. Epub 2010 Jun 9.
28. I. Gleiser, E. Hunt, The permanent first molar: its calcification, Am. J. Phys. Anthropol. 13 (1955) 253–284.