

Correlation of dental and chronological age using radiographs

¹Devika warrier E, ²Dr.Nithya jagannathan

¹Under Graduate, ²Senior lecturer
Saveetha Dental College and Hospital,
Saveetha University
162, Poonamalle high road,
Velappanchavadi,
Chennai- 600095.
India.

ABSTRACT:

BACKGROUND:-Accurate age data are always necessary in medicine and dentistry, and are also important to assess maturity and estimate age in a number of disciplines, such as forensic odontology, paediatric and preventive dentistry, orthodontics, etc. The use of radiographs for age estimation is characteristic of techniques that involve observation of the morphologically distinct stages of mineralization.

AIM:- The study aims to assess dental age and its correlation to chronological age using orthopantomographic radiographs.

MATERIALS AND METHODS:- A total of 100 patients were divided into two groups. 50 males and 50 females. The chronological age was assessed by recording their date of birth. An orthopantomogram was taken and dental age was assessed for all the patients.

RESULTS:- A high significant correlation was observed between dental age and chronological age.

CONCLUSION:-Examination of dental radiographs is a simple, non-destructive method that can be employed both on living individuals and on the unknown dead, either in identification cases or in archaeological investigations. Hence this study assess the dental age with the use of orthopantomograms.

Keywords: Chronological age, Dental age, Orthopantomograms

INTRODUCTION

:-

Dental age estimation has gained acceptance because it is less variable when compared to other skeletal and sexual maturity indicators[1] The two major approaches of dental age estimation are (i)age of tooth eruption and (ii)pattern of tooth development.[2]. Age of tooth eruption was widely accepted earlier, but now considered imprecise, because eruption is an ongoing process that includes periods in the life of a child when no tooth erupts into the oral cavity[3]. Premature extraction of primary teeth and crowding of permanent teeth are some of the factors which affects the tooth eruption[4].Alternatively, the development of teeth using radiographs can be assessed over long periods of time, in a continuous pattern, using different stages of tooth formation as criteria[5].

Dental age can be accurately assessed during childhood since many teeth are developing simultaneously. The first and most usual method for dental age assessment was visual inspection of dental eruption. The chronological age of children with uncertain birth records are often estimated by evaluating the individuals somatic maturity. Owing to a comparatively low variability of tooth formation in relation to chronological age[1], it seems that methods based on stages of tooth formation are more appropriate in assessment of chronological age than those based on other indicators of somatic development. Eruption and calcification of dental tissues has been used to determine dental age. Tooth calcification is superior to tooth emergence because emergence of a tooth fleeting event and its precise time is very difficult to determine whereas calcification is a continuous process that can be assessed by permanent records such as x-ray films. For these, dental formation of calcification which is a continuous developmental process, should be considered a better measure of physiological maturity than dental emergence⁴. The principal aim of this study is to determine the dental age from orthopantomograph using Demirjian method and to evaluate nature of interrelationship between chronological and dental age.

MATERIALS AND METHODS :-

The study was conducted in Saveetha dental college and hospitals. The sample consisted of 100 panoramic radiographs of teeth from 50 boys and 50 girls, age group of 6-30 years known chronologic age.

The exclusion criteria were as follows

- (i) The subject should be clinically free from any developmental disorder
- (ii) The subject should not undergo any orthodontic treatment.
- (iii) The subject with pathological conditions, trauma and fracture of jaw were excluded.

The development of the seven permanent left mandibular teeth was determined. Tooth formation was divided into eight stages and criteria for the stages were given for each tooth separately. Each stage of the seven teeth was given score. The sum of the score for the seven teeth was transferred to a dental age. Chronologic age of an individual was calculated by subtracting the birth date from the date on which the radiographs were exposed for that particular individual. Dental development evaluation followed the Demirjian method which is based on eight stages of tooth formation. The first four stages (A-D) show the crown formation from the beginning of cusp calcification to completed crown and the rest 4 stages (E-H) shows the root formation from initial radicular bifurcation to apical closing. The chronological age and the dental age was compared using the t test.

RESULTS :-

The study had a total of 100 children, 50 males and females respectively. The age group selected

was 6 to 30. The maturity scores obtained were converted to dental age using the Demirjian

conversion table. (table 1, table 2)

Table 1 :- maturity scores for boys

AGE	SCORE	AGE	SCORE	AGE	SCORE	AGE	SCORE
3	12.4	7	46.7	11	92	15	97.6
3.1	12.9	7.1	48.3	11.1	92.2	15.1	97.7
3.2	13.5	7.2	50	11.2	92.5	15.2	97.8
3.3	14	7.3	52	11.3	92.7	15.3	97.8
3.4	14.5	7.4	54.5	11.4	92.9	15.4	97.9
3.5	15	7.5	56.8	11.5	93.1	15.5	98
3.6	15.6	7.6	59.6	11.6	93.3	15.6	98.1
3.7	16.2	7.7	62.5	11.7	93.5	15.7	98.2
3.8	17	7.8	66	11.8	93.7	15.8	98.4
3.9	17.6	7.9	69	11.9	93.9	15.9	98.5
4	18.2	8	71.6	12	94	16	98.6
4.1	18.9	8.1	73.5	12.1	94.2		
4.2	19.7	8.2	75.1	12.2	94.4		
4.3	20.4	8.3	76.4	12.3	94.5		
4.4	21	8.4	77.7	12.4	94.6		
4.5	21.7	8.5	79	12.5	94.8		
4.6	22.4	8.6	80.2	12.6	95		
4.7	23.1	8.7	81.2	12.7	95.1		
4.8	23.8	8.8	82	12.8	95.2		
4.9	24.6	8.9	82.8	12.9	95.4		
5	25.4	9	83.6	13	95.6		
5.1	26.2	9.1	84.3	13.1	95.7		
5.2	27	9.2	85	13.2	95.8		
5.3	27	9.3	85.6	13.3	95.9		
5.4	28.6	9.4	86.2	13.4	96		
5.5	29.5	9.5	86.7	13.5	96.1		
5.6	30	9.6	87.2	13.6	96.2		
5.7	31.1	9.7	87.7	13.7	96.3		
5.8	31.8	9.8	88.2	13.8	96.4		
5.9	32.6	9.9	88.6	13.9	96.5		
6	33.6	10	89	14	96.6		
6.1	34.7	10.1	89.3	14.1	96.7		
6.2	35.8	10.2	89.7	14.2	96.8		
6.3	36.9	10.3	90	14.3	96.9		

6.4	38	10.4	90.3	14.4	97		
6.5	39.2	10.5	90.6	14.5	97.1		
6.6	40	10.6	91	14.6	97.2		
6.7	42	10.7	91.3	14.7	97.3		
6.8	43.6	10.8	91.6	14.8	97.4		
6.9	45.1	10.9	91.8	14.9	97.5		

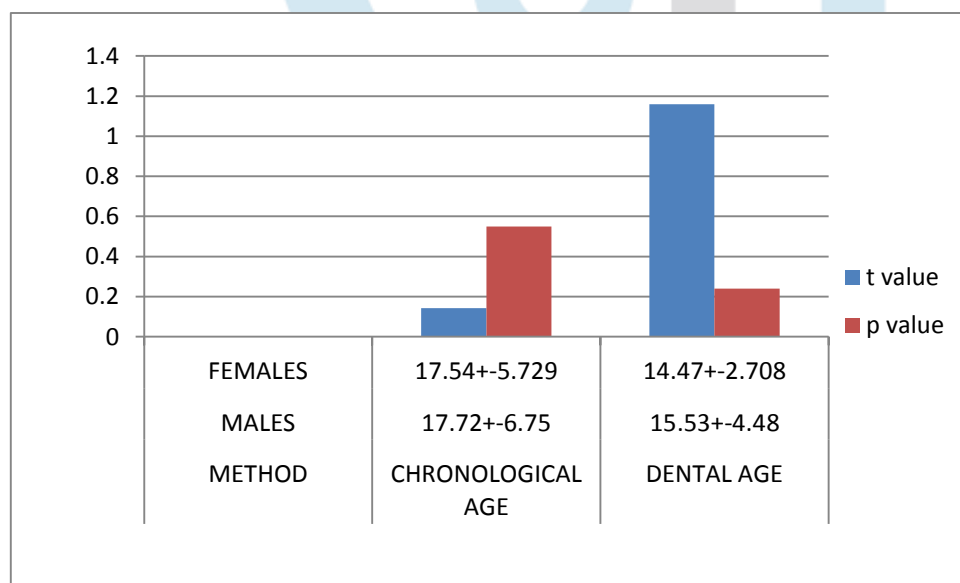
Table 2 :- maturity scores for girls

AGE	SCORE	AGE	SCORE	AGE	SCORE	AGE	SCORE
3	13.7	7	51	11	94.5	15	99.2
3.1	14.4	7.1	52.9	11.1	94.7	15.1	99.3
3.2	15.1	7.2	55.5	11.2	94.9	15.2	99.4
3.3	15.8	7.3	57.8	11.3	95.1	15.3	99.5
3.4	16.6	7.4	61	11.4	95.3	15.4	99.5
3.5	17.3	7.5	65	11.5	95.4	15.5	99.6
3.6	18	7.6	68	11.6	95.6	15.6	99.7
3.7	18.8	7.7	71.8	11.7	95.8	15.7	99.8
3.8	19.5	7.8	75	11.8	96	15.8	99.8
3.9	20.3	7.9	77	11.9	96.2	15.9	99.9
4	21.0	8	78.8	12	96.3	16	100
4.1	21.8	8.1	80.2	12.1	96.4		
4.2	22.5	8.2	81.2	12.2	96.5		
4.3	23.2	8.3	82.2	12.3	96.6		
4.4	24	8.4	83.1	12.4	96.9		
4.5	24.0	8.5	84.8	12.5	96.7		
4.6	24.8	8.6	84.8	12.6	96.8		
4.7	26.4	8.7	85.3	12.7	96.9		
4.8	27.8	8.8	86.1	12.8	97		
4.9	28	8.9	86.7	12.9	97.1		
5	28.9	9	87.2	13	97.2		
5.1	29.7	9.1	87.8	13.1	97.3		
5.2	30.5	9.2	88.3	13.2	97.4		
5.3	31.3	9.3	88.8	13.3	97.5		
5.4	32.1	9.4	89.3	13.4	97.6		
5.5	33	9.5	89.8	13.5	97.7		
5.6	34	9.6	90.2	13.6	97.8		
5.7	35.1	9.7	90.7	13.7	97.9		
5.8	36.8	9.8	91.1	13.8	98		
5.9	37	9.9	91.4	13.9	98.1		
6	38	10	91.8	14	98.2		
6.1	39.1	10.1	92.1	14.1	98.3		
6.2	40.2	10.2	92.3	14.2	98.4		
6.3	41.3	10.3	92.6	14.3	98.5		
6.4	42.5	10.4	92.9	14.4	98.6		
6.5	43.9	10.5	93.2	14.5	98.7		
6.6	46.7	10.6	93.5	14.6	98.8		
6.7	46.7	10.7	93.7	14.7	98.9		
6.8	48.0	10.8	94	14.8	99		
6.9	49.5	10.9	94.2	14.9	99.1		
					99.2		
GENDER				TOTAL			
MALE				50			
FEMALE				50			

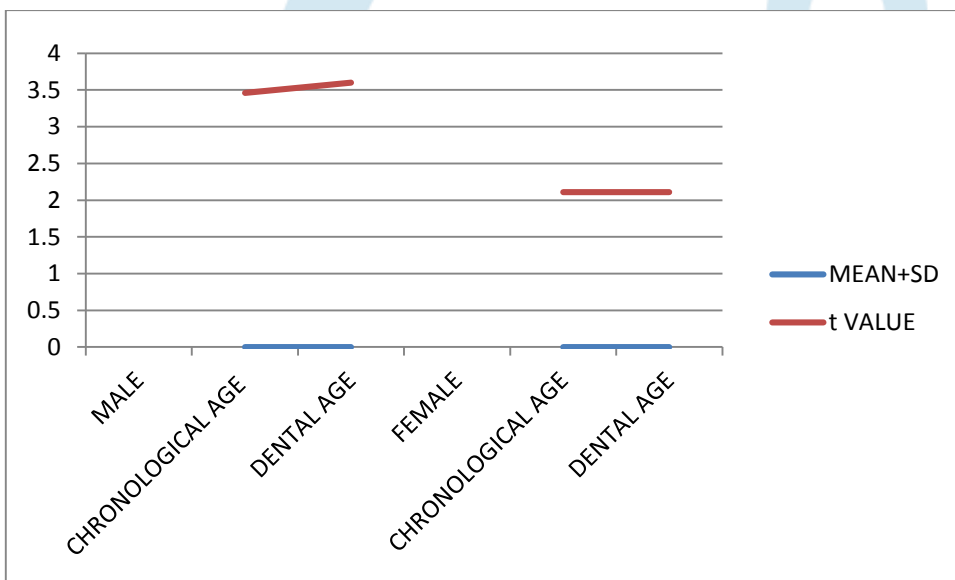
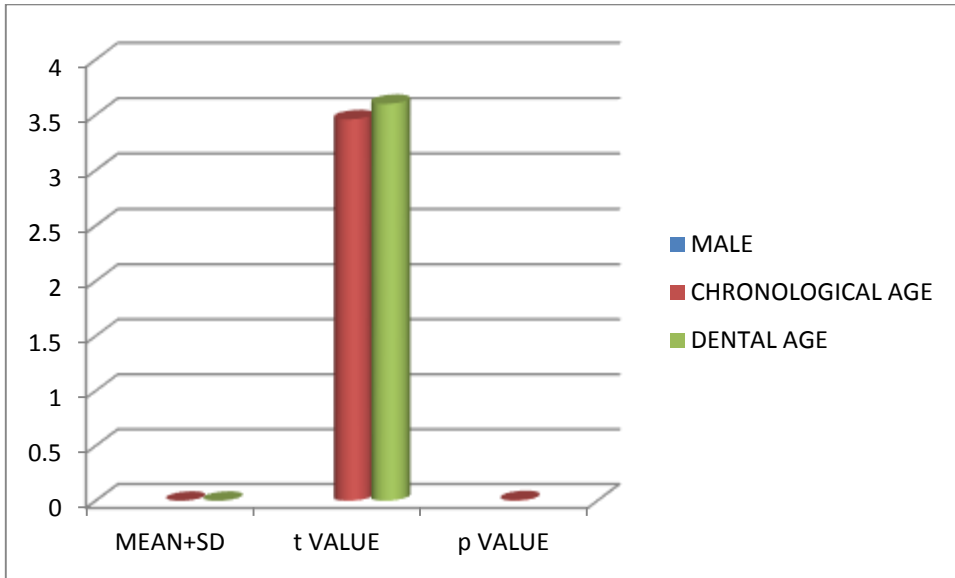
METHOD	MEAN+- SD	T VALUE	P VALUE
MALE			
CHRONOLOGICAL AGE	17.72+-6.875	3.46	0.0061
DENTAL AGE	15.53+-4.48	3.6	
FEMALE			
CHRONOLOGICAL AGE	17.54+-5.729	2.11	0.0061
DENTALAGE	14.47+-2.708	2.11	

METHOD	MEAN+- SD	MEAN +-SD	T VALUE	P VALUE
	MALES	FEMALES		
CHRONOLOGICAL AGE	17.72+-6.75	17.54+-5.729	0.142	0.55
DENTAL AGE	15.53+-4.48	14.47+-2.708	1.16	0.24

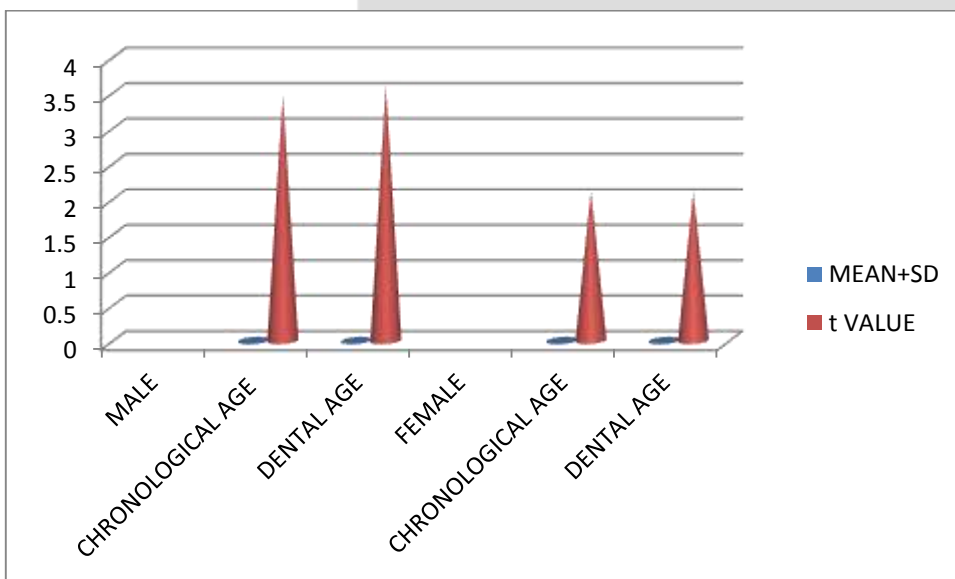
Graph 1 – comparison of t value and p value between males and females



Graph 2 :- t value of chronological and dental age among males.



Comparison of chronological age and dental age.



By comparing the values of the chronological age and the obtained dental age it was found out that the chronological age and the dental age was found to be statistically significant.

DISCUSSION :-

Dental age correlates closely with chronological age in children development. Studies have shown that dental development relates more closely to chronological age than skeletal, somatic or sexual maturity indicators [6]. Tooth formation has been more widely used than tooth eruption for assessing dental maturation because it is a continuous and progressive process that can be followed radio graphically, and most teeth can be evaluated at each examination. When information about the formation stages of several teeth is combined, the dental age of an individual can be estimated [7]. There are several methods for estimating dental age. The most widely used method is proposed by Demirjian. Different types of radiographs, like oblique cephalogram, oblique jaw Radiography (Lewis and Garn)[8], intraoral radiographs (Nolla1960)[9], Orthopantomography (Demirjian1971)[10] have been used to investigate dental development, but the panoramic radiographs used in the present study have been adopted by most authors due to their accessibility and the possibility to visualize all teeth [11,12,13,14]. The mandibular teeth were chosen because they can be easily visualized on the panoramic radiograph.

Chronological age and dental age showed significant correlation between male and female sample. This is in agreement with Jaeger [15], Malagola [16], Carvalho et al[17]. Males and females of younger group showed high correlation between true and assessed age. When demirjian method was used the mean difference between the true and assessed age was minimal. This showed the accuracy of demirjian method in age estimation. This was in support with Nanda and chawla 1966 8 and demirjian 1971 [10] . However there are many studies going on to support this fact. Demirjian system utilizes eight stages of development for each of the seven left mandibular teeth, altogether 56 stages of which only the 26 stages are given searate scores , specific for sex. Only 16 out of 26 stages are attained within the younger group of present study and 12 to 13 stages with the older group.

CONCLUSION :-

Development of individual teeth is of prime importance but they need a method of evaluating the overall development status of mouth. This is mainly provided by the dental maturity measure[18]. The assessment of dental age , stages of calcification can be reliable indicator as the teeth progressively calcify with the definite age. It is important to note that the dental age assessment is independent of somatic growth[19]. In the present study we evaluated the inter relationship between chronological and dental age using the demirjian method. From this present study we found out that the Demirjian method showed high accuracy in age estimation.

REFERENCES:

- 1 Demerjian A, Buschang PH, Tanguay R, Patterson DK. Interrelationships among measures of somatic, skeletal, dental, and sexual maturity. *Am J Orthod* 1985; 88: 433–438.
- 2 Demerjian A. *Dentition*. New York: Plenum Press, 1978.
- 3 Leurs IH, Wattel E, Aartman IH, Eddy E, Prahl-Andersen B. Dental age in Dutch children. *Eur J Orthod* 2005; 27: 309–314.
- 4 Loevy HT. The effect of primary tooth extraction on the eruption of succedaneous premolars. *J Am Dent Assoc* 1989; 118: 715–718.
- 5 Nolla CM. The development of the permanent teeth. *J Dent Child* 1960; 27: 254–266.
6. Lewis AB, Garn SM. The relationship between tooth formation and other maturational factors. *Angle Othod.* 1960;30(2):70-7.
7. Nystrom M, Ranta R, Kataja M, Silvola H. Comparisons of dental maturity between the rural community of Kuhmo in northeastern Finland and the city of Helsinki. *Community Dent Oral Epidemiol.* 1988;16(4):215-7.
8. Garn S.M. Lewis A.B. : The sex difference in tooth calcification *J. Dent. Res.* 1958 ;:37: 561.
9. Nolla C.M .: The development of the ten permanent teth . *J . Dent. Child* 1960; 27: 254.
10. Sapoka A. and Demirjian A.: Dental development of the french Canadian child *J. CANAD , Dent Assn .* 1971; 3 : 100-104.
- 11- Leurs IH, Wattel E, Aartman IH, Eddy E, Prahl-Andersen B. Dental age in Dutch children. *Eur J Orthod.* 2005;27(3):309-14.
- 12 Ferreira ER Júnior, Santos-Pinto LAM, Santos-Pinto R. Estágio de mineralização dental: análise comparativa entre sexos. *Rev Odont UNESP.* 1993;22(2):303-13.
- 13 Sierra AM. Assessment of dental and skeletal maturity: a new approach. *Angle Orthod.* 1987;57(3):194-208.
- 14 Stefanac-Papic J, Alkadri KZ, Legovic M, Galic N. Comparison of dental maturity between two ethnic groups. *Coll Antropol.* 1998;22:123-6.
15. Jaeger U : Dental age in dependence on the stage of selected physi ological development parameters - stomat 1990 Dec . 40 (12) : 511514.
16. Malagola C, Caigiuri F.M . , Barrato E . : Evaluation of dental age using qualitative radiographic analysis mondo- ortho.
17. Carvalho A.A. Decarvalho A: Radiographic study of the development of prmanent dentition of Brazilian children with chronologic age of 84 and 131 months. *Odontol. Revy.* 1991; 19 (1) : 31-39.
18. Maber, M. and H. Liversidge, 2006. Accuracy of age estimation of radiographic methods using developing teeth. *J. Forensic Sci. Int.*; May, 15(159-1): S68-73.
19. Moorrees, C. and E. Fanning, 1963. Age variation of formation stages for ten permanent teeth. *J. Dent. Res.*, 42(6): 1490-1502.