Sahani and Tyagi, J Forensic Res 2019, 10:1
DOI: 10.4172/2157-7145.1000436

Journal of Forensic Research
ISSN: 2157-7145

Research Article Open Access

Dental Maturity as a Predictor of Chronological Age

Sahani P[1], Tyagi R[1*]

Department of Anthropology, Forensic Science Section, University of Delhi, Delhi, India

Abstract

Objective: Present study was conducted to study association between chronological age and biological age on the basis of dental maturity.

Methodology: The study was conducted among the children belonging to the 10-11 years age group. Eruption of teeth or somatic tooth development was recorded visually and photographically. Dental formula of the respondents, dental problems and anomalies were recorded. The data was analyzed using frequency distribution and percentage for selected factors like dental hygiene, food preferences, socio-economic status etc.

Result: Teeth eruption was reported to be earlier among girls than boys; Dental anomalies, dental problems like cavities, plaque and blackening were also reported among respondents.

Conclusion: The dental maturity was reported to be relatively faster among girls as compared to boys, Association between dental maturity and chronological age were reported among boys and girls both.

Keywords: Dental age, Forensic investigation, Children, Biological age, Chronological age

Introduction

Dental development relates more closely to chronological age as compared to skeletal, somatic or sexual maturity indicators [1]. Age estimation is an important aspect of forensic odontology and it is crucial for personal identification in forensic analysis. It is also used in the case of living persons when the age is disputed. The age of an individual, up to 25 years, can be determined, within a range of one to two years, from a combination of data provided by teeth, ossification of bone, height and weight and some other miscellaneous particulars. For age estimation from teeth, it is necessary to know the difference between the two sets of teeth, the time of their eruption, and the period when their root calcification is complete. Chronological age is defined as the numeric value of days from the date of birth to the date at present time of an individual. In absence of recorded date of birth, chronological age cannot be estimated correctly, and then assessment of age can be done by dentition. As human teeth undergo many changes in a person's life, dental age assessment can be a very reliable source of age determination. Chronological age (CA) and biological (BA) are correlated with each other and discrepancies between CA and BA are due to intra-population variability and differences in aging. The biological age of some children is more than chronological age due to either good nutrition or hyperpituitarism. The correlation between dental and chronological age is also useful in forensic dentistry.

Human teeth are diphyodont, as these are replaced only one time. There are two sets of teeth namely temporary and deciduous or milk teeth and Permanent teeth. Temporary teeth are 20 in number, i.e., 4 incisor, 2 canines and 4 molars in each jaws. Permanent teeth are 32 in number, i.e., 4 incisor, 2 canines, 4 premolar and 6 molars in each jaw. Growth and development of tooth can be divided into 5 major developmental stages: Initiation Budding stage Cap stage Bell stage and Apposition stage [2]. Dental eruption timing and dental development have been used to determine dental age [3,; Bagh et al, 2014). Tooth calcification is superior to tooth emergence because emergence of a tooth a transitory event and its precise time is very difficult to determine. However, calcification is a continuous process that can be easily assessed [4]. Teeth have highly mineralized structure, which makes them resistant to the postmortem decomposition and generally withstand flames, alkalis or acids [5]. Even bone may disintegrate, but teeth can be preserved for a long time and thus can be used reliably for identification in disaster situations [6].

Since teeth are extremely resistant to decomposition, environmental factors and, to a certain extent fire, they are of crucial importance for identification, especially when soft tissues have been altered for various reasons. The dental age is reliable for evaluating the ages of cases in anthropological, forensic, medico legal cases, paediatric dentistry and orthodontist plan. Visual method is based on the sequence of eruption of the teeth and morphological changes that are caused due to function such as attrition, changes in color that are indicators of aging. Dental maturity is one of the most reliable indicators of chronological age estimation method used for criminal, forensic and anthropologic purposes [7,8]. The odontological studies may help forensic expert, both for personal identification in criminal investigation and other criminal cases like rapes, and physical abuse. Examination of dentition considering the tooth wear/attrition, tooth color and stains, periodontal status, etc. can provide valuable information on an individual's development and age [9,10].

The chronological age determination in children and adolescents can be done by counting the number of teeth and types of teeth i.e. whether deciduous or permanent. Rai et al and Madhulika et al reported significant correlation between dental age, skeletal age and chronological age in children and concluded that females attain maturity earlier than males [11,12]. Subait et.al studied the extent of oral health knowledge, attitude and behavior of students and concluded

***Corresponding author:** Renu Tyagi, Department of Anthropology, Forensic Science Section, University of Delhi, Delhi, India, Tel: 01147534876; E-mail: renutyagiindia@gmail.com

Received November 03, 2018; **Accepted** January 11, 2019; **Published** January 18, 2019

Citation: Sahani P, Tyagi R (2019) Dental Maturity as a Predictor of Chronological Age. J Forensic Res 9: 436. doi:10.4172/2157-7145.1000436

that girls have better knowledge for dental health, but there was no significant difference reported towards dental health between two genders. In the present study, dental development, dental maturity, dental hygiene and dental anomalies of the children were studied. Various factors influencing the dental characteristics were also studied. An association between biological and chronological age was analyzed using dental maturity [13].

Methodology

The present study was conducted in various regions of Delhi NCR (Figure 1) including Garima-garden (Uttar Pradesh), Vishnu-garden (New-Delhi), Vaishali (New-Delhi) and Wazirabad (New-Delhi) among children of 10-11 years. The chronological age was calculated on the basis of recorded date of birth of child. Total sample size was 32 children (15 boys and 17 girls) belonging to a mixed population from urban areas of Delhi NCR. Most of the respondents belonged to middle-class socio-economic group. Educational level of the parents of the participants varied from primary level to graduation level. The criteria for selection of cases for the present study were as follows:

1. The participant should be clinically free from any disorder as this may affect development of teeth among respondents. 2. Participant should be clinically free from any past prolonged illness.

A consent form for the parents and two proformas, one each for parent and children with questions covering the objectives was prepared. A dental chart was also prepared. The basic information asked in the proforma included the details like sex, date of birth, parents' qualification, family size, and monthly income of family. Information regarding the dental hygiene among children and type of food preferences were also asked from children. Before performing oral examination of children, consent of parents was taken. Then, teeth were counted and details of teeth were recorded in the pre-structured tables. For example, number of each kind of teeth i.e. incisors, canines, premolars & molars were recorded. Moreover, notes were also prepared for dental problems and anomalies. Simultaneously photographs of teeth were also taken to study the dental problems like plaque, blackening, and any other kind of dental anomalies.

Eruption of teeth or somatic tooth development was recorded visually and photographically and the dental formula was recorded accordingly. The data collected was entered in MS-Excel sheets for further analysis. The data was analyzed using frequency distribution and percentage for selected factors like dental hygiene, food preference, education qualification of mother & father, profession of mother & father, monthly income of family, and family size etc.

Figure 1: Map of Delhi-NCR

Results

6.66% of total numbers of boys do not brush even once a day, whereas all girls do brushing either once or twice. Overall, dental hygiene of girls was found to be better than boys. Subait et al. in their study also concluded that girls brush their teeth more frequently than boys. The girls were reported to be more conscious of their oral hygiene than boys (Figure 2). Most of the girls preferred sweet foods as compared to salty food (Figure 3). Among boys there was found to be an equal preference for sweet and salty food preferences. In right upper jaw, the number of incisors was 100% complete in count for both boys and girls; and in left upper jaw, the number of incisors were 100% complete in count for both boys and girls. Hence, incisors in right upper jaw were fully erupted and calcified for both boys and girls; and incisors in left upper jaw were fully erupted and calcified for both boys and girls (Table 1).

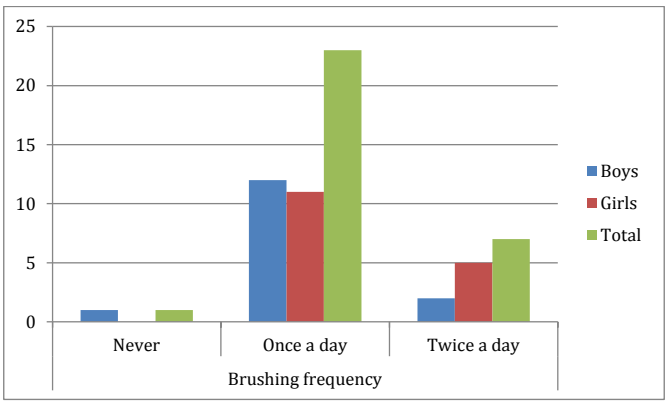

Figure 2: Brushing pattern among respondents

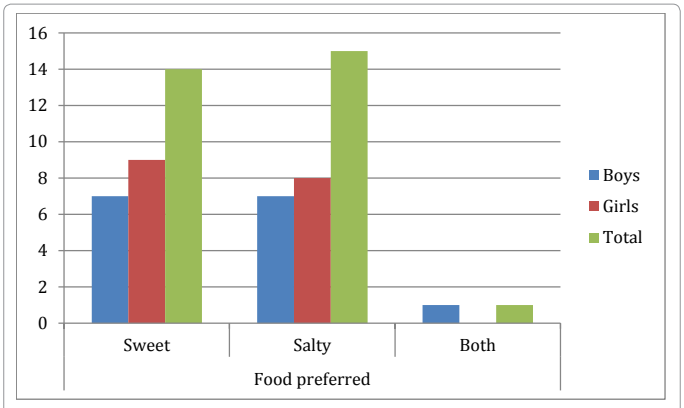

Figure 3: Food preferences among respondents

About 6.7% of total number of boys and 5.9% of total number of girls were lacking canine at right upper jaw, that could be due to the reasons either canines has not erupted yet or there was diastema from birth. Almost 93.3% of total number of boys has fully erupted canine but this frequency is bit lesser than that of girls i.e. 94.2% of total number of girls. For left upper jaw, it depicts that about 13.3% of total

number of boys and 5.9% of total number of girls were lacking canine, that could be due to the reasons either canines has not erupted yet or there is diastema from birth. Almost 86.7% of total number of boys has fully erupted canine but this frequency was quite lesser than that of girls i.e. 94.2% of total number of girls (Table 2).

Table 3 depicts that around 5.88% of total number of girls are not having even a single right upper jaw premolar. About 80% of total number of boys and 70.7% of total number of girls were having single premolar whereas 20% of total number of boys and 23.5% of total number of girls were having 2 premolars. For left upper jaw it depicts that around 5.9% of total number of girls and 6.7% of total number of boys were not having even a single premolar. 70.3% of total number of boys and 70.6% of total number of girls were having single premolar whereas 20% of total number of boys and 23.5% of total number of girls were having 2 premolars. Overall, girls as compared to boys had fully erupted total number of premolars.

Twenty percent of total number of boys and 11.8% of total number of girls were having single right upper jaw molar whereas, 80% of total number of boys and 88.2% of girls were having 2 molar. Overall, girls as compared to boys had more fully erupted total number of molars. For left upper jaw, it was depicted that 13.3% of total number of boys and 11.8% of total number of girls were having single molar whereas, 86.7% of total number of boys and 88.2% of girls were having 2 molar. Overall, girls as compared to boys had better eruption of total number of molars (Table 4).

Table 5 depicts that in 13.3% of total number of boys, only one right lower jaw incisor was erupted, and in 86.7% of boys both incisors were erupted. Whereas, 100% of total number of girls have both incisors erupted. Overall, girls have better eruption of right lower jaw incisors. For left lower jaw, it depicts that in count, incisors were completely erupted among both boys and girls. In right upper jaw, incisors are fully erupted and calcified for both and girls. Table 6 displays that 6.7% of total number of boys and 5.9% of total number of girls were lacking canine in right upper jaw. This could be due to the reasons that either canines have not erupted yet or there is diastema from birth. More than 93 percent of total number of boys has fully erupted canine but this frequency was found to be less than that of girls (94.2%). Overall, girls have better eruption of right lower jaw canine than boys. For left lower jaw, it depicts that 6.7% of total number of boys and 5.9% of total number of girls were lacking canine, that could be due to the reasons that either canines has not erupted yet or there is diastema from birth. 93.3% of total number of boys and 94.2% of total number of girls showed fully erupted canine.

	Numbers of incisors(right)						Numbers of incisors (left)					
Respondents	n	%	n	%	n	%	n	%	n	%	n	%
	0	-	1	-	2	-	0	-	1	-	2	-
Boys (15)	0	0	0	0	15	100	0	0	0	0	15	100
Girls (17)	0	0	0	0	17	100	0	0	0	0	17	100
Total (32)	0	0	0	0	32	100	0	0	0	0	32	100

Table 1: Distribution of upper jaw incisors among respondents

	Upper jaw canine (right)				Upper jaw canine (left)			
Respondents	n	%	n	%	n	%	n	%
	0	-	1	-	0	-	1	-
Boys (15)	1	6.7	14	93.3	2	13.3	13	86.7
Girls (17)	1	5.9	16	94.2	1	5.9	16	94.2
Total (32)	2	6.4	30	93.8	3	9.6	30	90.4

Table 2: Distribution of upper jaw canine among respondents

	Upper jaw premolars (right)						Upper jaw premolars (left)					
Respondents	n	%	n	%	n	%	n	%	n	%	n	%
	0	-	1	-	2	-	0	-	1	-	2	-
Boys (15)	0	0	12	80	3	20	1	6.7	11	70.3	3	20
Girls (17)	1	5.9	12	70.6	4	23.5	1	5.9	12	70.6	4	23.5
Total (32)	1	2.9	24	75.3	7	21.8	2	6.3	23	71.9	7	21.8

Table 3: Distribution of upper jaw premolars among respondents

	Upper jaw molars (right)						Upper jaw molars (left)					
Respondents	n	%	n	%	n	%	n	%	n	%	n	%
	0		1		2		0		1		2	
Boys (15)	0	0	3	20	12	80	0	0	2	13.3	13	86.7
Girls (17)	0	0	2	11.8	15	88.2	0	0	2	11.8	15	88.2
Total (32)	0	0	5	15.9	27	84.1	0	0	4	12.5	28	87.5

Table 4: Distribution of upper jaw molars among respondents

	Lower jaw incisors (right)						Lower jaw incisors (left)					
Respondents	n	%	n	%	n	%	n	%	n	%	n	%
	0	-	1	-	2	-	0	-	1	-	2	-
Boys (15)	0	0	2	13.3	13	86.7	0	0	0	0	15	100
Girls (17)	0	0	0	0	17	100	0	0	0	0	17	100
Total (32)	0	0	0	6.7	32	93.3	0	0	0	0	32	100

Table 5: Distribution of lower jaw incisors (right) among respondents

Table 7 depicts that around 13.3% of total number of boys did not show any premolar in right upper jaw. Out of total number of boys, 66.7 % of boys and 64.70% of total number of girls were having one premolar whereas 20% of total number of boys and 35.4% of total number of girls were having 2 premolars. Overall, girls as compared to boys have good frequency of fully erupted total number of premolars. For lower left jaw, it depicts that around 5.9% of total number of girls and 6.7% of total number of boys were not having even a single premolar. About 70.3% of total number of boys and 70.6% of total number of girls were having single premolar whereas 20% of total number of boys and 23.5% of total number of girls were having 2 premolars. Overall, girls as compared to boys have better eruption of premolars.

Single molar in right upper jaw was reported among 13.3% of total number of boys and 17.6% of total number of girls. Whereas, 86.7% of total number of boys and 82.3% of total number of girls were having 2 molars. Overall, girls as compared to boys have better eruption of total number of molars in right lower jaw. For left lower jaw, it depicted that 13.3% of total number of boys and 17.6% of total number of girls were having single molar whereas, about.86.7% of total number of boys and 82.3% of girls were having 2 molars. Overall, girls as compared to boys

	Lower jaw canine (right)				Lower jaw canine (left)			
Respondents	n	%	n	%	n	%	n	%
	0	-	1	-	0	-	1	-
Boys (15)	1	6.7	14	93.3	1	6.7	14	93.3
Girls (17)	1	5.9	16	94.2	1	5.9	16	94.2
Total (32)	2	6.4	30	93.8	2	2.9	30	93.8

Table 6: Distribution of lower jaw canine (right) among respondents

	Lower jaw premolars (right)						Lower jaw premolars (left)					
Respondents	n	%	n	%	n	%	n	%	n	%	n	%
	0	-	1	-	2	-	0	-	1	-	2	-
Boys (15)	2	13.3	10	66.7	3	20	1	6.7	11	70.3	3	20
Girls (17)	0	0	11	64.7	6	35.4	1	5.9	11	64.7	5	29.4
Total (32)	2	6.7	21	65.7	9	27.6	2	6.3	22	67.5	8	24.7

Table 7: Distribution of lower jaw premolars (right) among respondents

	Lower jaw molars (right)						Lower jaw molars (left)					
Respondents	n	%	n	%	n	%	n	%	n	%	n	%
	0		1	-	2	-	0	-	1	-	2	-
Boys (15)	0	0	2	13.3	13	86.7	0	0	2	13.3	13	86.7
Girls (17)	0	0	3	17.6	14	82.4	0	0	3	17.6	14	82.4
Total (32)	0	0	5	15.5	27	84.5	0	0	5	15.5	27	84.5

Table 8: Distribution of lower jaw molars (right) among respondents

	Blackening of teeth				Plaque formations				Cavities at upper jaw				Cavities at lower jaw			
Respondents	LJI	%	UJM	%	LJI	%	UJI	%	UJL	%	UJR	%	LJL	%	LJR	%
Boys (15)	0	0	0	0	4	26.7	0	0	4	26.7	5	33.3	3	20	2	13.3
Girls (17)	1	5.9	1	5.9	2	11.8	1	5.55	3	17.6	5	29.4	6	35.3	7	41.2

LJI: lower jaw incisor, UJI: upper jaw incisor UJM: upper jaw molar

Table 9: Dental problems among respondents

had better eruption of total number of molars in left lower jaw (Table 8).

Table 9 depicts that blackening was reported in both lower and upper jaw of girls (5.9%) only. Plaque formation was observed among 26.7% of total number of boys and 11.8% of total number of girls on LJI. In Upper jaw incisors (UJI), plaque formation was reported among 5.5% of girls. Overall plaque formation was reported to be more among boys as compared to girls. Cavities were present in both left and right upper jaw, but more cavities were reported in right upper jaw. Boys showed more cavities as compared to girls in upper jaw. An equal number of cavities were reported in both right and left lower jaw. Girls showed more cavities as compared to boys in the lower jaw.

Discussion and Conclusion

In this study, the teeth development i.e. eruption and calcification was found to be better faster in girls as compared to boys. Temitope et al also concluded that score of tooth eruption and maturity score was higher in girls as compared to boys. In the present study, 20% of boys and 23% girls were having either 26 or 25 teeth i.e. extra number of teeth as per their chronological age [14]. This indicated that as per dental maturity, the biological age was more than the chronological age for these children and faster growth among girls than boys. These findings are in corroboration with earlier studies [11,12]. 6 % girls & 7 % 15 boys reported lesser biological age as compared to their chronological age. For most of the respondents (81%), the biological age was reported to be same as their chronological age indicating an association between dental and chronological age.

Overall the dental hygiene was found to be better among girls as compared to boys. A preference for sweet food was more among girls than boys which could be responsible for more number of cavities among them than boys. Moreover cases of blackening among girls and more plaque formation among boys were found. Other anomalies found among the respondents included broken tooth, diastema, absence of teeth and presence of extra tooth [15]. Most of the anomalies are related to incisors. Dental anomalies were more among girls than boys. The dental maturity of girls was earlier than that of boys. An association between dental and chronological age was reported in the present study.

Acknowledgements

We are thankful to the Forensic Science Section, Department of Anthropology, University of Delhi, India for support given for this study Authors are thankful to all respondent for their patience and cooperation. Without their valuable support it would not be possible to conduct this research. We are grateful to Prof. Satwanti Kapoor for providing with essential suggestions to bring out this work effectively. Financial assistance to RT by University Grant Commission (UGC)-Delhi is greatly acknowledged.

References

1. Lewis AB, Garn SM (1960) The relationship between tooth formation and other maturational factors. Angle Orthod 30: 70-77.
2. Avery J (2000) Essentials of Oral Histology and Embryology, 2nd edition.
3. Liversidge HM, Smith BH, Maber M (2010) Bias and accuracy of age estimation using developing teeth in 946 children. Am J Phys Anthropol 143: 545-554
4. Hegde RJ, Sood PB (2002) Dental Maturity as an indicator of chronological age: Radiographic Evaluation of Dental age in 6 to 13 years respondents of Belgaum using Demirjian Methods. J Indian Soc Pedo Prev Dent 4: 132-138.
5. Reesu GV, Augustine J, Urs AB (2015) Forensic considerations when dealing with incinerated human dental remains. J Forensic Legal Med 29: 13-17.
6. Nayar AK, Parhar S, Thind G, Sharma A, Sharma D (2017) Determination of age, sex, and blood group from a single tooth. J Forensic Dent Sci. 9: 10-14.

7. Lewis JM, Senn DR (2010) Dental age estimation utilizing third molar development: A review of principles, methods, and population studies used in the United States. Forensic Sci Int201: 79-83.

8. Celik S, Zeren C, Çelikel A, Yengil E, Altan A (2014) Applicability of the Demirjian method for dental assessment of southern Turkish children. J Forensic Leg Med 25: 1-5.

9. Willems G, Moulin-Romsee C, Solheim T (2002) Non-destructive dental-age calculation methods in adults: Intra- and inter-observer effects. Forensic Sci Int 126: 221-226.

10. Kvaal S (2006) Collection of post mortem data: DVI protocols and quality assurance. Forensic Sci Int 159: 12-14.

11. Vivek R, Saha S, Yadav G, Tripathi AM, Grover K (2014) Dental and Skeletal Maturity-A Biological Indicator of Chronologic age. J Clin Diagn Res 8: ZC60-ZC64.

12. Macha M, Lamba B, Avula JSS, Muthineni S, Margana PGJS et al., (2017) Correlation between Chronological Age, Skeletal Age and Dental Age in Respondents. Journal of clinical and diagnostic research 11: ZC01-ZC04.

13. Subait AAA, Alousaimi M, Geeverghese M, Ali A, Metwally AE (2016) Oral health knowledge, attitude and behavior among students of age 10–18 years old attending Jenadriyah festival Riyadh; a cross-sectional study. Saudi J Dent Res 7: 45-50.

14. Temitope Ayodeji Esan, Veerasamy Yengopal, Lynne A. Schepartz (2017), The Demirjian versus the Willems method for dental age estimation in different populations: A meta-analysis of published studies. PLOS ONE 12: e0186682.

15. Donna J. Cech (2012) Functional Movement development Across the Life Span, 3rd edition.