Applicability of Willems method of dental age estimation to the population of Raichur city of Karnataka

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Abstract

Introduction: Dental age is one of the parameter for the growth assessment and tooth calcification provides a better measure of dental age in comparison to tooth eruption. There are numerous methods available in literature to determine dental age based on tooth calcification. Nowadays Willem's method is gaining wider recognition because many studies have proved its accuracy in various populations in Western countries but very few studies are available about its applicability to Karnataka State population (South Indian Population). Hence this study has been carried out to test the applicability of Willem's method to the population (children) of Raichur city of Karnataka state (south Indian population).

Materials and Methods: Sample size of 250 south Indian children in 6-13 years age group participated in the study out of which there were 111 females and 139 were males. Dental age was calculated using Willems method and chronological age was determined using date of birth. Pearson's correlation coefficient and students" t" test was applied for statistical analysis of the data.

Results: There was positive correlation between two ages in both genders. 0.06 years was the mean difference in total male sample and 0.07 years was the mean difference in total female sample.

Conclusion: The mean difference between chronological and dental age was very minimal and both ages were positively correlated thus indicating that Willem's method was accurately applicable to the children of Raichur city of Karnataka state (south India). To support our observations we recommend further studies with larger sample size.

Keywords: Chronological age, Dental age, Willem's method.

Introduction

Dental maturation provides a valuable insight into total maturity of the individual. Dental age is determined based on tooth calcification rate. Level of tooth calcification, right from each stage of development from beginning of tooth bud calcification to completion of root formation is taken as dental maturation. Tooth calcification was considered better measure to assess dental maturation in comparison to the eruption status of teeth. Numerous procedures are available to determine dental age and Demirjian's method was used successfully in many investigations.[1]

Dental age is one of the parameter for the growth assessment, so for better understanding of the growth impingement on the maturation of dental tissues, a detailed analysis of tooth calcification is very important.[2] Dental age is very useful for dental disciplines for planning the treatment and its helpful for other medical disciplines as a secondary information.[3]

Determination of dental and chronological age will be helpful to assess growth and to establish correlation between 2 ages. Dental age varies in socio-demographic groups and also in various geographical conditions. Many methods have been applied to assess dental age in various population groups.

Demirjian's method[4,5] was successfully applied on many ethnic groups. The newer and easier version of Demirjian's method is known as Willem's method. Because of its high accuracy and easy methodology many studies have used Willem's method[6-10] in western population. Only little research[11-15] has been done to investigate the suitability of Willems method on south Indian population and the applicability of Willems method was not studied in population of Raichur city of Karnataka state (south India). Hence this investigation was done to determine the applicability of Willems method to the population of Raichur city of Karnataka state (south India)

Materials and Methods

Ethical clearance committee of the institution approved the study. Parent/ guardian consent was obtained before the conduct of the study on children. The sample for the present study has been obtained from the out patients of the Department of Pedodontics. Total 250 healthy south Indian children between the age groups of 6-13 years without any growth disorders or systemic problems participated in the study. Chronological age was recorded after subtracting the date of birth with that of date on which Orthopantomogram (OPG) was obtained. Willem method was applied in this study to assess dental age.[9]

Dental age estimation: Willem's method was used which has 8 calcification stages similar to Demrjians method.[9] In Demirjian's method[4,5] tooth calcification has been divided into 8 stages from A to H (Fig. 1). Demirjian considered developmental stages of 7 left permanent mandibular teeth from central incisor to 2nd

molar. Every tooth on left mandibular arch has been assigned particular score value depending on its degree of calcification (Table 1 and 2). The sum of individual scores of 7 teeth is known as maturity score of the individual which is converted in to dental age using conversion chart. Willem's method[9] is identical to Demirjian'smethod with respect to calcification stages of 7 left mandibular teeth but in Willems method the tables (Table 3 and 4) have developmental age for particular calcification stage (A to H) which is in contrast to the score value of Demirjians method. As per Willems method, the dental age is the sum of developmental ages of 7 left mandibular teeth (dental age= developmental ages of 31+32+33+34+35+36+37).

Method of dental age estimation using Willems method:[9] From each of study subject the Orthopantomogram was obtained. The particular calcification stages from A to H, of left 7 permanent mandibular teeth was assessed using Orthopantomogram and developmental age of that particular stage of each tooth was recorded from the table 3and 4and the sum of developmental ages of 7 teeth was known as dental age of the individual.

Pearson's correlation coefficient and students" t" test was applied for statistical analysis of the data.

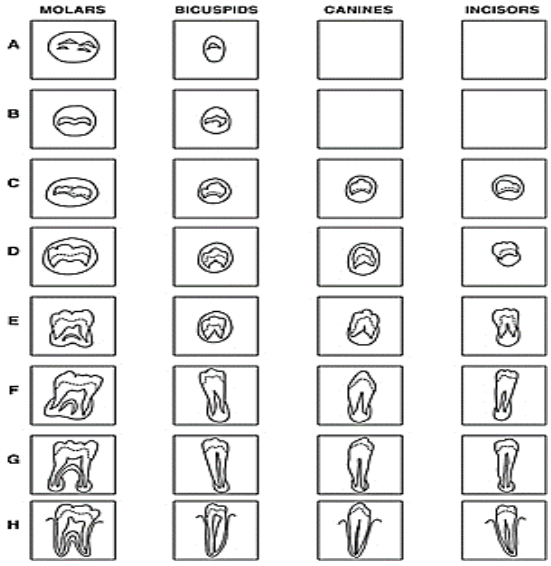

Fig. 1: Demirjians tooth calcification stages

Results

Total sample size was 250. Gender Distribution of total sample has been formatted in table 5, and the difference in means of 2 ages of all age groups has been given in table 6.

The highest mean difference of 0.26 years in females has been found out in 9 years children, and 0.211 years is the high mean difference observed in male sample of 7 years age group (Table 6).

0.087 years was the lowest mean difference was obtained in females was obtained at the age group of 6 years, and 0.10 years was the lowest mean difference observed in males at the age group of 9 years (Table 6).

0.06 years was the mean difference between chronological age and dental age in total male sample (Table 7). And 0.07 years was the mean difference between chronological and dental age in total female sample (Table 7).

0.069 years was the mean difference of total sample size (Table 7).

0.911was the correlation value determined between dental and chronological age in overall total sample size (Table 8).

7 years age group had the highest correlation value (r=0.932) (Table 9), and 11 years age group had the lowest correlation value (r=0.817) (Table 9).

0.891 was the correlation value in total male and 0.912 was the correlation value in total female sample (Table 10).

Table 1: Demirjian's self-weighted score values of dental stages of 7 teeth (mandibular left side) in boys

Tooth	Stages							
	A	B	C	D	E	F	G	H
M2	2.1	3.5	5.9	10.1	12.5	13.2	13.6	15.4
M1			0.0	8.0	9.6	12.3	17.0	19.3
PM2	1.7	3.1	5.4	9.7	12.0	12.8	13.2	14.4
PM1		0.0	3.4	7.0	11.0	12.3	12.7	13.5
C			0.0	3.5	7.9	10.0	11.0	11.9
LI				3.2	5.2	7.8	11.7	13.7
CI				0.0	1.9	4.1	8.2	11.8

M2: Permanent second molar M1: Permanent first molar PM2: Second premolar PM1: First premolar
C: Canine LI: Lateral Incisor CI: Central Incisor

Table 2: Demirjian's self-weighted score values of dental stages of 7 teeth (mandibular left side) in girls

Tooth	Stages							
	A	B	C	D	E	F	G	H
M2	2.7	3.9	6.9	11.1	13.5	14.2	14.5	15.6
M1			0.0	4.5	6.2	9.0	14.0	16.2
PM2	1.8	3.4	6.5	10.6	12.7	13.5	13.8	14.6
PM1		0.0	3.7	7.5	11.8	13.1	13.4	14.1
C			0.0	3.8	5.6	10.3	11.6	12.4
LI			0.0	3.2	5.6	8.0	12.2	14.2
CI				0.0	2.4	5.1	9.3	12.9

M2: Permanent second molar M1: Permanent first molar PM2: Second premolar PM1: First premolar
C: Canine LI: Lateral Incisor CI: Central Incisor

Table 3: Willem's developmental age of each calcification stage of 7 mandibular left side teeth in boys

Tooth	Stages							
	A	B	C	D	E	F	G	H
M2	0.18	0.48	0.71	0.8	1.31	2	2.48	4.17
M1				0.69	1.14	1.6	1.95	2.15
PM2	0.08	0.05	0.12	0.27	0.37	0.45	0.4	1.15
PM1	0.15	0.56	0.75	1.11	1.48	2.03	2.43	2.83
C				0.04	0.31	0.47	1.09	1.9
LI			0.55	0.63	0.74	1.08	1.32	1.64
CI			1.68	1.49	1.5	1.86	2.07	2.19

M2: Permanent second molar M1: Permanent first molar PM2: Second premolar PM1: First premolar
C: Canine LI: Lateral Incisor CI: Central Incisor

Table 4: Willem's developmental age of each calcification stage of 7 Mandibular Left Side Teeth in girls

Tooth	Stages							
	A	B	C	D	E	F	G	H
M2	0.14	0.11	0.21	0.32	0.66	1.28	2.09	4.04
M1				0.62	0.9	1.56	1.82	2.21
PM2	-0.19	0.01	0.27	0.17	0.35	0.35	0.55	1.51
PM1	-0.95	-0.15	0.16	0.41	0.6	1.27	1.58	2.19
C			0.6	0.54	0.62	1.08	1.72	2
LI				0.29	0.32	0.49	0.79	0.7
CI			1.83	2.19	2.34	2.82	3.19	3.14

M2: Permanent second molar M1: Permanent first molar PM2: Second premolar PM1: First premolar
C: Canine LI: Lateral Incisor CI: Central Incisor

Table 5: Study sample distribution

Age	Males	Females	Females +males
6	17	13	30
7	16	12	28
8	19	15	34
9	19	13	32
10	16	14	30
11	18	13	31
12	17	15	32
13	17	16	33
Total	139	111	250

Table 6: Age wise comparison of chronological age & dental age

Age	Sex	chronological age	dental age	Mean difference	t-value	p-value	Inference
6	**Male**	6.554 ± 0.21	6.676 ± 0.41	0.122	0.67	0.61	NS
	Female	6.667 ± 0.31	6.754 ± 0.23	0.087	0.97	0.41	NS
	Total	6.610 ± 0.21	6.715 ± 0.27	0.105	0.12	0.84	NS
7	**Male**	7.664 ± 0.19	7.453 ± 0.24	0.211	0.87	0.32	NS
	Female	7.543 ± 0.22	7.674 ± 0.22	0.131	0.47	0.65	NS

	Total	7.603 ± 0.24	7.563 ± 0.25	0.04	0.68	0.51	NS
8	**Male**	8.543 ± 0.32	8.675 ± 0.21	0.13	0.96	0.45	NS
	Female	8.675 ± 0.32	8.789 ± 0.17	0.11	0.92	0.31	NS
	Total	8.609 ± 0.17	8.732 ± 0.14	0.12	1.15	0.17	NS
9	**Male**	9.467 ± 0.22	9.568 ± 0.12	0.10	0.22	0.77	NS
	Female	9.675 ± 0.32	9.408 ± 0.27	0.26	0.63	0.69	NS
	Total	9.571 ± 0.14	9.488 ± 0.17	0.08	0.38	0.76	NS
10	**Male**	10.675 ± 0.18	10.459 ± 0.19	0.21	0.48	0.67	NS
	Female	10.653 ± 0.16	10.787 ± 0.14	0.13	1.08	0.31	NS
	Total	10.664 ± 0.19	10.623 ± 0.16	0.04	0.34	0.73	NS
11	**Male**	11.765 ± 0.18	11.579 ± 0.11	0.18	0.61	0.70	NS
	Female	11.679 ± 0.22	11.532 ± 0.26	0.14	0.97	0.29	NS
	Total	11.722 ± 0.19	11.555 ± 0.16	0.16	0.93	0.32	NS
12	**Male**	12.607 ± 0.11	12.734 ± 0.23	0.12	0.63	0.58	NS
	Female	12.674 ± 0.26	12.581 ± 0.21	0.09	0.68	0.53	NS
	Total	12.640 ± 0.18	12.657 ± 0.13	0.01	0.37	0.69	NS

Table 7: Gender wise comparison of chronological age & dental age

Sex	chronological age	dental age	Mean difference(years)	t-value	p-value	Inference
Male	9.582 ± 2.07	9.645 ± 2.11	0.06	0.082	0.87	NS
Female	9.658 ± 2.15	9.736 ± 2.35	0.07	0.075	0.89	NS
Total	9.621 ± 2.02	9.690 ± 1.87	0.069	0.016	0.91	NS

Table 8: Total sample correlation of chronological age & dental age

	Number	Correlation coefficient (r) value	p-value	Inference
Overall	250	0.911	P<0.0001	Significant

Table 9: Age wise correlation between chronological age & dental age

Age (years)	Number	Correlation coefficient (r) value	p-value	Inference
6	29	0.889	P<0.0001	Significant
7	33	0.932	P<0.0001	Significant
8	34	0.895	P<0.0001	Significant
9	34	0.911	P<0.0001	Significant
10	39	0.889	P<0.0001	Significant
11	43	0.938	P<0.0001	Significant
12	38	0.817	P<0.0001	Significant

Table 10: Gender wise correlation between chronological age & dental age

Sex	Number	Correlation coefficient (r) value	p-value	Inference
Male	139	0.891	P<0.0001	Significant
Female	111	0.912	P<0.0001	Significant

Discussion

There are many methods used to detect dental age in many ethnic groups. Hagg and Matsson[16] have found out that Demirjians method was well accepted method for many countries and for different set of populations.

Nanda and Chawla[17] and Hedge and Sood[2] have suggested that Demirjinas method is most useful method for the detection of dental age on Indian population.

We have applied Willems method in our investigation, Ye et al.[8] and Yusof et al.[10] proved that dental age assessment using Willem's method is very simple to assess and more accurate in comparison to other methods.

Our investigation found that in both genders dental and chronological ages were positively correlated this result is in accordance with the findings of Prabhakar et al.[1] Vallejo-Bolanos et al.[3] Hegde and Sood.[2] Many studies have been done by various authors and they found that maturity indices of body like dental, chronological and bone ages are positively correlated.

In our findings the total male sample had 0.06 years difference between dental and chronological age and in total female sample it was 0.07 years, our observations are in accordance with the below following studies:

Ambarkova et al.[7] proved that Willems method was accurate in comparison to Demirjians method in children of Former Yugoslavic Republic of Macedonia.

Mohammed et al.[11] did a study to determine Nollas, Demirjian's, Willems and Haavikko methods for the accuracy of dental age determination in 6-16 years age group children of south Indian origin and they are in opinion that all above methods are accurate in assessment of dental age in South Indian children.

Priya et al.[12] did a study on 30 males and 30 female children at Tamil Nadu under the age group of 14 years. The outcome of the study was the minimal difference between dental and chronological age thus indicating that Willem's method can be applicable to Tamil Nadu children of south India.

Thetay et al.[13] conducted a retrospective study on 6-17 years children by studying 660 Orthopantomograms to compare Demirjian's and Willem's method. Their study resulted that both methods were reliable for South Indian children.

Patnana et al.[14] studied the accuracy of Demirjian's, Haavikko's and Willem's method for dental age calculation of Visakhapatnam children of South Indian origin. They applied 3 methods on children between the age group of 6-14 years and they found that Willem's method was more reliable on Visakhapatnam children (South India) compare to Demirjian's and Haavikko's method.

Kapoor et al.[15] has proved that Willems method is applicable to Himachali children after studying dental age using Willems method on 55 Himachali children in 6-14 years age group.

In our investigation 0.06 years and 0.07 years was the mean difference in both male and female samples respectively indicating that the method described by Willems is suitable to the population of Raichur city of Karnataka (South India).

Conclusion

The mean difference between chronological and dental age was very minimal in both genders and both ages were positively correlated thus indicating that Willem's method was accurately applicable to the children of Raichur city of Karnataka state (south India). To support our observations we recommend further studies with larger sample size.

Conflict of Interest: Authors declare that there is no conflict of interest

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