Dental Age Estimation Using Willems Method In Mangalore Population: A Radiographic Study.

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ABSTRACT

Introduction: Age estimation is an integral part of forensic science. Various methods have been developed in age estimation by using dental radiography. Dental radiography is an effective tool in estimation of dental age and it can correlate with unknown age. It also has an advantages of being non invasive unlike any other methods employing histological sections and various anthropological measurements.

Aim and objectives: The aim of the present study is to estimate the Dental Age (DA) in different age groups by assessing the developmental stages of mandibular seven teeth by using Willems method. And evaluate the possible correlation between DA and Chronological Age (CA).

Materials and Methodology: Digital Orthopantomograms (OPGs) of 30 subjects were used in the study. Mandibular teeth from central incisor to the second molar were selected, and DA was assessed using Willems method.

Results: The study shows mean difference between the estimated DA and CA for males was 0.6786 years while for females 0.1187 years. The overall mean difference between DA and CA according to Willems method was 0.3800 years and is statistically not significant.

Conclusion: This study showed significant correlation between estimated DA and CA. Thus, digital radiographic assessment of mandibular teeth development can be used to generate DA by using Willems method and also the estimated age range for an individual of unknown CA.

Keywords: Age estimation, chronological age, dental age, forensic odontology, Willems method.

INTRODUCTION:-

Dental age (DA) estimation is required in various aspects such as in paediatric dentistry, orthodontics, archaeology, palaeontology and forensic dentistry.[1] In certain communities, the chronological age (CA) of living people play a very important role in matters regarding social benefits, employment and marriage.[2] Age of an unknown person can be assessed by correlating some factors such as physical, skeletal, and dental maturity of an individual. The technique of DA estimation is useful when the child with an unknown CA.[3] Several methods have been published for assessing dental development, which is generally referred to as dental aging. Dental aging appears in two forms: depending on Tooth mineralization and tooth eruption patterns.

The aim of this study is to estimate the dental age in different age groups by assessing the developmental stages of mandibular teeth by using Willems method, and to evaluate the possible correlation between DA & CA.

MATERIALS AND METHOD:

The present study was conducted in the department of Oral medicine & Radiology, Yenepoya Dental College & Hospital, Mangalore The radiographs were selected from the archives of the Oral medicine & Radiology Department. The sample size was 30 patients and each OPG (digital) was taken by Planmeca machine under standard protocols and radiographs were measured using Agfa NX software.

The study requires patients aged between 6 - 16 years, with no medical history of systemic diseases or nutritional disorders and Standardised OPGs are selected with no positional errors.

The study excluded Patients with Serious medical illness (endocrine diseases), congenital developmental abnormalities, Impacted or ankylosed teeth present, physically or mentally challenged children and patients undergone maxillofacial surgery.

The CA of each individual is calculated by subtracting the birth date from the date on which the radiographs were exposed for that particular individual. Digital OPG of all children were used to assess the status of maturation on the basis of calcification of the permanent teeth in the left side of mandible, from central incisor to the second molar. In case of mandibular left tooth was missing right side tooth selected for scoring. In this method the tooth formation is divided in to eight stages and criteria of these stages for each tooth were given separately. After noting all stages of teeth from central incisor to the second molar, the developmental status of a particular tooth was calculated in years on the basis of tables given by Willems *et al.* (FIGURE 1), and sum up the values and convert the value in to age by using Demirijian conversion chart.

FIGURE I
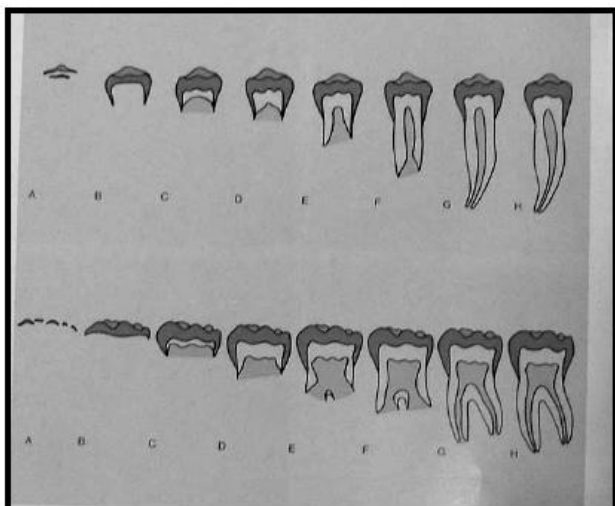
A- Calcified cusp tips that are not fused.
B- Calcified cusp tips that are fused with

well-defined occlusal surface outline.
C- Complete formation of enamel at occlusal surface. Commencement of dentinal deposition.
D- Completion of crown formation upto cement enamel junction. Root formation is seen and pulp horns begin to differentiate.
E- Pulp horns and pulp chamber are more differentiated. Root length is less than crown length. Radicular bifurcation is visible in molars.
F- Funnel shaped apex is seen. Crown length is equal and greater than root length.
G- Root canal walls are parallel and the apical ends are still open.
H- Apical ends are closed and uniform periodontal ligament space is seen around the tooth.

RESULTS:

The present study was conducted with 30 sample size, in which 16 females and 14 males. The mean chronological age of 30 samples - 13.3, while the mean estimated age of 30 samples-13.7 (TABLE 1)

(TABLE 1) MEAN CHRONOLOGICAL AGE AND MEAN ESTIMATED AGE OF 30 SAMPLES

	N	Mean	Std. Deviation
CHRONOLOGICAL AGE	30	13.367	1.866
ESTIMATED AGE	30	13.747	2.117

The correlation between chronological age and estimated age - .874 and it is statistically significant [p value < 0.05] (TABLE 2).

(TABLE 2) CORRELATION BETWEEN CHRONOLOGICAL AGE AND ESTIMATED AGE OF 30 SAMPLES

	N	Correlation	Sig.
CHRONOLOGICAL AGE & ESTIMATED AGE	30	.874	.000

In males :

The mean chronological age - 13.14, The mean estimated age - 13.8

In females :-

The mean chronological age - 13.5, The mean estimated age - 13.6 (TABLE 3).

(TABLE 3) Mean Chronological Age And Mean Estimated Age Of Males And Females

GENDER		N	Mean	Std. Deviation
Male	CHRONOLOGICAL AGE	14	13.143	2.033
	ESTIMATED AGE	14	13.821	1.976
Female	CHRONOLOGICAL AGE	16	13.563	1.750
	ESTIMATED AGE	16	13.681	2.296

The correlation between chronological age and estimated age in males - .945 while in females - .851 and it is statistically significant [p value < 0.05] (TABLE 4).

(TABLE 4) CORRELATION BETWEEN ESTIMATED AGE AND CHRONOLOGICAL AGE OF MALES AND FEMALES

GENDER		N	Correlation	Sig.
Male	CHRONOLOGICAL AGE & ESTIMATED AGE	14	.945	.000
Female	CHRONOLOGICAL AGE & ESTIMATED AGE	16	.851	.000

The mean difference between the estimated DA and CA for males - 0.6786 years while for females 0.1187 years (TABLE 5).

(TABLE 5) MEAN DIFFERENCE BETWEEN CHRONOLOGICAL AGE AND ESTIMATED AGE OF MALES AND FEMALES

| GENDER		Paired Differences			
		Mean	Std. Deviation	t	p
Male	CHRONOLOGICAL AGE - ESTIMATED AGE	-.6786	.66585	1.810	.068
Female	CHRONOLOGICAL AGE - ESTIMATED AGE	-.1187	1.22432	-.388	.703

The overall mean difference between DA and CA according to Willems method was 0.3800 years and is statistically not significant [p value > 0.05] (TABLE 6)

(TABLE 6)

MEAN DIFFERENCE BETWEEN CHRONOLOGICAL AGE AND ESTIMATED AGE OF 30 SAMPLES

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	Paired Differences			
	Mean	Std. Deviation		
Pair 1 CHRONOLOGICAL AGE - ESTIMATED AGE	-.3800	1.02701	-1.027	.152

The graph showing the correlation between chronological age and estimated age (FIGURE 2) (FIGURE 2)
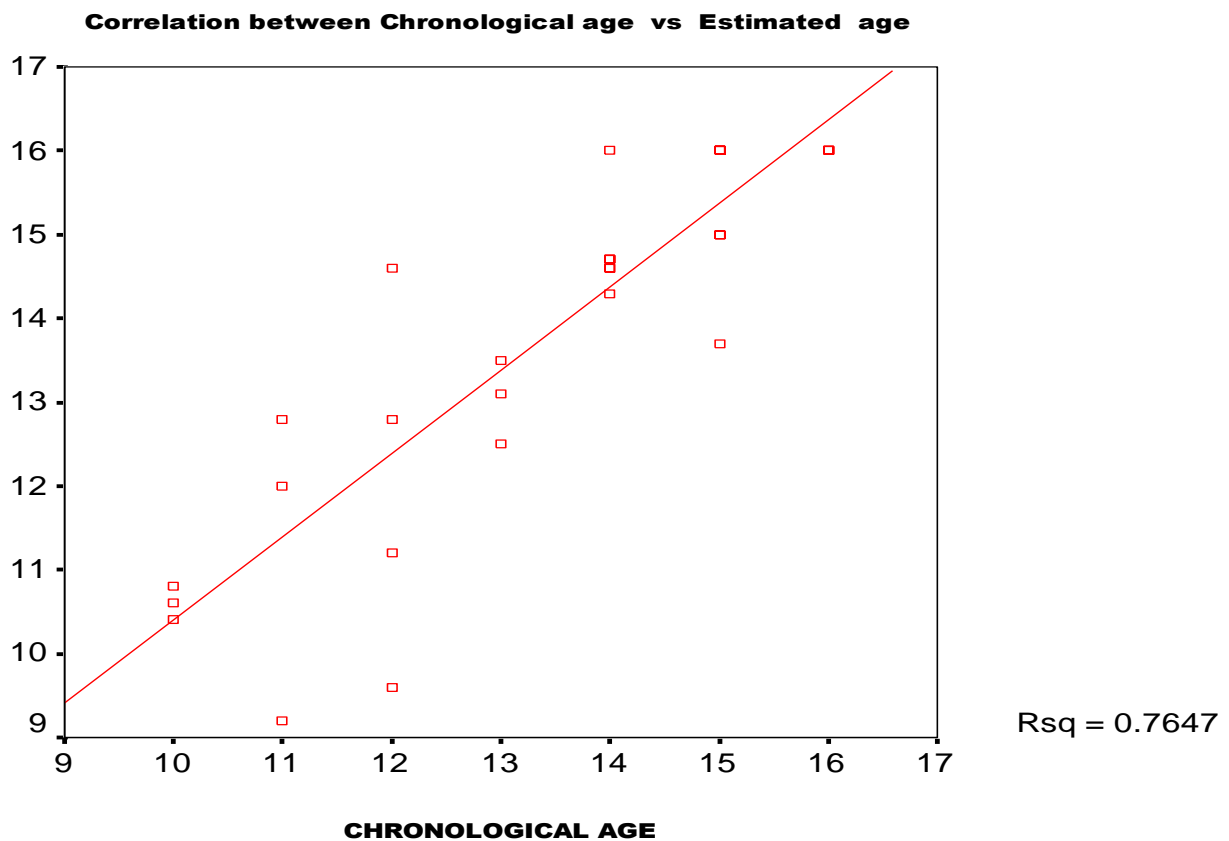
DISCUSSION:

Developing teeth in radiographs are frequently used for estimating age by assessing the dental maturity status. Age estimation has become increasingly important in now a days because identification of age is very important for a variety of reasons, including identifying criminal and legal responsibility and for many other social events such as a birth certificate, beginning a job, marriage, joining the army, and retirement.[4]

The evaluation of mineralization of teeth from OPGs is the most suitable method for estimation of age because a single radiograph gives the complete developmental status of dentition.[5] In addition digital OPGs were used as the images can be magnified to make assessment easier. Subjects with history of trauma to the face were excluded as it may lead to delayed eruption or early mineralization of teeth and also with gross malocclusion were excluded as it may lead to discrepancies during staging of teeth development.

The various methods of age assessment showed high degrees of reliability and ethnic differences between various populations were found to affect

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the accuracy resulting in overestimation or underestimation of the DA. In 2001, Willems *et al.*,[6] evaluated the accuracy of Demirjian's method and they concluded that no two individuals grow and develop at the same rate. [7]Tooth development has variations among populations and these differences exist between several ethnic groups worldwide. So, this study was performed to compare the DA assessment in Mangalore children.

In the present study, the overall mean difference between the estimated DA and CA for males was .6786+- .66585years while for females was .1187± 1.22 years. These gender differences in the entire sample were not statistically significant. This may be due to the fact that Willems method gives separate standards for each sex, accounting for sexual differences. When the entire sample was considered, underestimation of age was noted, in agreement with previous studies. These differences can be explained by the difference in sample size, method of age calculation, age groups, the age and sex distribution of the original study population and statistical methodologies.

When comparison among gender is done, females mature earlier than males, but the mean difference between DA and CA was not statistically significant. In contrast to previous studies, the present study slightly underestimated the age in Mangalore population.[8,9,10] This delay in dental maturation may be partly explained by the environmental factors, genetic variations, population differences, socio-economic status, nutrition, dietary habits, and lifestyle.

Moreover, it is equally important to realize that no methods for estimation of age will accurately determine the exact age of the individual, since development naturally varies between individuals. DA is not same for all children of a specific known age. Most important aspect of DA estimation is to remember that one should not restrict to only one age estimation technique, but to apply different techniques available and perform repetitive measurements and calculations.

CONCLUSION:

Age estimation plays an important role in forensic, legal and social issues. When Willems method of age estimation has been applied to Mangalore population, slightly underestimation of age was noted leading to delayed dental maturity compared to previous studies. In this study, significant relation was found between estimated DA and CA and thus the Willems method seems to be applicable in estimating age in Mangalore children. As no published data is available regarding the application of Willems method in selected population, this paper provides an insight in using Willems method in Mangalore population for estimating mean age of a child with unknown CA.

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