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APPLICABILITY OF MODIFIED DEMIRJIAN METHOD COMPREHENSIVE CHART (DAEcc) IN GUJARATI POPULATION

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ABSTRACT

INTRODUCTION - Age estimation is an essential identification for every individual to prove their identity not only forensically it is important in every day life. Humans are differentiate grossly on the basis of age, vulnerability of individual is subjected on basis age group individual belongs like in recent time of pandemic the severity of symptoms is found more in older individuals and vaccinations is provided on the basis of vulnerability of specific age group. Age estimation is also useful in human trafficking, child labor, forced marriages and illegal organ trafficking even for consent in major surgeries.

METHOD - There are several methods for age estimation more accurately skeleton age estimation from long bones is consider but in several cases dental age estimation produced good results such as in cases of extensive fire, acid burn or even advance skeleton decomposition. Here we have concentrated upon radiographic methods of dental age estimation in which Demirjian method for 7 tooth formula is used as well as DAECc 8 chart is also used for age estimation

It was found that DAEcc7 is more easy and less time consuming Demirjian original formula shows more accuracy over Indian formula in DAEcc8 and 7.

KKEYWORDS – Dental age estimation, Demerjian method , Forensic dental profiling, 7tooth formula , 8 tooth formula

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complete my Research report.

INTRODUCTION:

Age is important entity for individual to prove his identity. Age is a long process which happens over the course of years in individuals life. Age related changes occur in a slow process for every individual this makes it difficult and challenging to determine the correct age or nearby standard deviation by the experts. [II] [III]

Age becomes critical to determine at various points such as at the time diminishing of a deceased to reconstruct its biological profile at life, in cases of child labor, in juvenile cases, in early marriage especially in India and in archeological reviving the information on the geospatial of the population.

METHODS: There are various methods available for determine the age of individual which includes

1. Visual
2. 2. Morphological/ Radio graphically
3. 3. Chemically
4. 4. Histological

RADIOGRAPHIC METHOD

These are the noninvasive methods which dont require extraction of tooth or the autopsy. The radiographic method required the small mirror image of the tooth which is obtain by various means such as Intra oral preapical x-ray, Orthopantogram, Cone beam technology or computer tomography and cephalometric . The radiological age determination is based on assessment of various features as follows: Jaw bones prenatally, Appearance of tooth germs, Earliest detectable trace of mineralization or beginning of mineralization, Early mineralization in various deciduous teeth during intrauterine life, Degree of crown completion, Eruption of the crown into the oral cavity, Degree of root completion of erupted or unerupted teeth, Degree of resorption of deciduous teeth, Measurement of open apices in teeth, Volume of pulp chamber and root canals/formation of physiological secondary dentine, Tooth-to-pulp ratio, Third molar development and topography. Age estimation is grouped into three phases: I. Pre-natal, neonatal and post-natal II. Children and adolescents III. Adults. [I][II][III][IV]

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REVIEW OF LITERATURE

Ipsita Mohanty et al. has done a study on Predictive accuracy of Demirjian's, Modified Demirjian's and India specific dental age estimation methods in Odisha (Eastern Indian) population Demirjian's (D), modified Demirjian's (MD) and India specific age estimation methods (AA) shows person correlation of 0.85, 0.86 and 0.38 respectively for boys and 0.78, 0.85 and 0.71 for girls. In present study person correlation for original formula was 0.6 and for Indian formula it was 0.2 [V]

Angelines Cruz-Landeira at el. In their study Dental age estimation in Spanish and Venezuelan children. Comparison of Demirjian and Chaillet's scores have found out that above mentioned method was not applicable for Indian population in 6-16 years of age group so present study was done with Indian derived formula and it was more useful for Indian population . [VI]

Amro M. Moness Ali et el. have done study Applicability of Demirjian's method for dental age estimation in a group of Egyptian children. Comparison was done between the estimated dental ages (EDA) and chronological ages (CA) among the studied children using an independent samples t-test. All age group are significant except female of 9 to 10 years, male of 4 to 5 years, male of 6 to 7 years' female of 9 to 10 and 10 to 11 years' findings of our study are described in result section [VII]

AIM: -

To determine the age of the individual more precisely by OPG from forensic perspective to serve law and justices.

OBJECTIVE:

1. To find out more précised method age estimation among the 7 tooth DAEcc chart or 8 tooth DAEcc chart for better appropriation
2. To find out the formula for more appropriate original Demirjian formula or the Indian formula.
3. To find out the association of the specific gender that shows less deviation with the applied formula.

METHODOLOGY:

This is a cross sectional Retro respective study that was conducted on Orthopantograms (OPG) of both the

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genders of male and female.

SAMPLING: Orthopantograms (OPG) were taken from the local native X-ray center OPG center verbal consents are taken from the patients and guardians to conduct the research 26 female 21 female were taken to conduct the experiment on Dental Age Estimation compressive chart (DAEcc)8 tooth.
Similarly, 21 females and 26 males Dental Panoramic X-rays were taken for DAEcc 7 tooth. Total 100 individuals Panoramas were taken for the research purpose.

INCLUSION CRETERIA:

1. Patients between 6 - 16years of age.
2. Patients whose chronological age (CA) could be accurately determined by date of birth (DOB).
3. Patients whose grandparents and parents have been residing in GUJARAT (boundaries defined by Ministry of Housing and Urban Affairs, Government of India), India.
4. Healthy patients with no reported growth abnormalities like amelo-genesis imperfect, regional odontodysplasia, nutritional deficiency, Downs syndrome etc.
5.Presence of all permanent mandibular teeth, specifically on left side of the arch whether erupted or un-erupted, on OPG taken for diagnostic and/or treatment purposes.

EXCLUSION CRITERIA

1. Patients having orthodontic treatment.
2. Patients with dental history of extraction of permanent teeth.
3. Patients with missing teeth particularly on left side of the mandible.

METHOD OF RESEARCH

The study design was divided into two stages 50 samples for DAEcc8 and 50 samples for DAEcc 7 wherein DA was estimated using original Demirjian method and DAEcc chart. 5mnts break was taken to avoid fatigue. Prior to beginning of dental age estimation, each OPG was allotted a unique ID by operator 1 and

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was blinded to operator 2. Chronological Age was calculated by determining the difference between date on which OPG was taken and patients DOB.

AGE ESTIMATION BY DAEcc7

Each OPG was taken particularly left side of lower mandible that is 3rd quadrant of oral cavity each tooth was compared to the stages enshrines in the chart and particular score were assigned for each tooth present in the quadrant. The total score was calculated by adding up all scores. The OPG was taken and traced on the butter paper and tracing was compared by putting it on the pictorial stages given on the chart so the particular weighted score was given to the tooth attained stage.

Patient ID: OPD NO.:

Gender: Nationality:

Date of data collection: Place of Origin:

Dentition present:

Determination of score based on developmental stages of tooth

Tooth No.	Developmental stages of tooth							
	A	B	C	D	E	F	G	H
31								
CS: By/Gr				0.0/0.0	1.9/2.4	4.1/5.1	8.2/9.3	11.8/12.9
32								
CS: By/Gr			0.0/0.0	3.2/3.2	5.2/5.6	7.8/8.0	11.7/12.2	13.7/14.2
								
33								
CS: By/Gr			0.0/0.0	3.5/3.8	7.9/7.3	10.0/10.3	11.0/11.6	11.9/12.4
								
34								
CS: By/Gr		0.0/0.0	3.4/3.7	7.0/7.5	11.0/11.8	12.3/13.1	12.7/13.4	13.5/14.1
35								
CS: By/Gr	1.7/1.8	3.1/3.4	5.4/6.5	9.7/10.6	12.0/12.7	12.8/13.5	13.2/13.8	14.4/14.6
								
36								
CS: By/Gr			0.0/0.0	8.0/4.5	9.6/6.2	12.3/9.0	17.0/14.0	19.3/16.2
37								
CS: By/Gr	2.1/2.7	3.5/3.9	5.9/6.9	10.1/11.1	12.5/13.5	13.2/14.2	13.6/14.5	15.4/15.6
								
Total score								

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Comprehensive Chart for Dental Age Estimation (DAEcc)

AGE ESTIMATION BY DAEcc8 modified by Chaillet and Demerjian

The OPG were taken age group from 3yr-16yr and traced on a butter paper particularly left side of mandible i.e., is quadrant 3rd of the oral cavity. The traced image was kept on the chart and particular teeth matched with pictorial stage are awarded with weightage of that stage on basis of sex of the individual.

CALCULATING THE AGE FROM DAEcc8

The total score which is obtained by adding the individual tooth score which obtained by the stages compared. The particular is put in place of 'S' in the formulas. The age is calculated by both the formulas Indian as well as the conventional formula of the Demerjian.

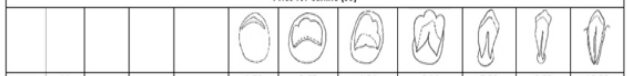
Comprehensive Chart for Dental Age Estimation Based on Demirjian 8-Teeth (DAEcc8)*

Patient/ Forensic Case ID: Gender:
Date of Birth (If Known): Chronological Age (If Known):
Nationality (If Known): Date of OPG:

Permanent Dentition present on OPG: (Circle/ Tick)

8 7 6 5 4 3 2 1 | 1 2 3 4 5 6 7 8
8 7 6 5 4 3 2 1 | 1 2 3 4 5 6 7 8

Score determination based on developmental stage of tooth

CS for tooth no.	M/ F	Developmental stages of teeth									
		0	1	2	3	4	5	6	7	8	9
PRCS for Incisors (31, 32)											
											
CS for 31	M	-	-	-	-	-	2.31	4.35	5.16	6.56	10.68
	F	-	-	-	-	-	**2.58**	**3.10**	**5.02**	**6.66**	**10.61**
CS for 32	M	-	-	-	-	-	2.55	4.71	5.75	6.97	10.91
	F	-	-	-	-	-	**2.65**	**4.54**	**5.40**	**7.02**	**10.89**
PRCS for Canine (33)											
											
CS for 33	M	-	-	-	1.70	2.67	4.34	6.14	7.59	9.52	12.56
	F	-	-	-	-	**2.55**	**3.15**	**5.40**	**7.19**	**9.22**	**11.99**
PRCS for Premolars (34, 35)											
											
CS for 34	M	-	-	1.70	1.98	3.52	5.19	6.47	8.18	9.84	12.57
	F	-	-	-	**2.56**	**3.54**	**5.09**	**6.31**	**8.09**	**9.82**	**12.29**
CS for 35	M	-	1.69	2.27	3.41	3.41	5.59	6.96	8.68	10.64	13.11
	F	-	-	**2.43**	**3.43**	**3.83**	**5.75**	**6.81**	**8.70**	**10.80**	**12.79**
PRCS for Molars (36, 37, 38)											
											
CS for 36	M	-	-	-	-	-	2.13	3.73	4.94	7.00	11.22
	F	-	-	-	-	-	**2.58**	**3.25**	**4.25**	**6.88**	**10.94**
CS for 37	M	1.70	2.98	3.41	4.74	4.88	6.69	7.89	9.08	11.13	13.63
	F	-	**2.57**	-	**2.65**	**4.10**	**6.51**	**8.00**	**9.13**	**11.00**	**13.84**
CS for 38	M	6.19	7.64	8.28	8.86	9.89	11.17	12.25	13.66	14.07	15.32
	F	**6.40**	**7.74**	**8.92**	**9.31**	**10.22**	**11.04**	**12.65**	**13.77**	**14.45**	**16.65**
Total Maturity Score (S)#											

*Adapted from the scoring and calcification stages given by Chaillet and Demirjian[13] and Nolla[7]
= CS(31 + 32 + 33 + 34 + 35 + 36 + 37 + 38)
Legend: FDI: Fédération Dentaire Internationale, CS: Corresponding Score, M: Males, F: Females, PRCS: Pictorial Representation of Calcification Stages

	Indian Formulas[16]	Original Formulas[13]
Males:	$27.4351 - (0.0097 \times S^3) + (0.000089 \times S^3)$	$(0.0000550 \times S^3) - (0.0095 \times S^2) + (0.6479 \times S) - 8.4583$
Females:	$23.7288 - (0.0088 \times S^2) + (0.000085 \times S^3)$	$(0.0000615 \times S^3) - (0.0106 \times S^2) + (0.6997 \times S) - 9.3178$

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- Confidence level is 95%

RESULTS

DAEcc 8 Results		
	INDIAN FORMULA	ORIGINAL FORMULA
P value	0.0923	< 0.0001
R squared	5.46%	60.57%
R squared (F)	39.51%	24.84%
R squared (M)	0.09%	19.37%

DAEcc 7 Results	
P Value	**< 0.0001**
R Squared	**78.21%**
R Squared (F)	**72.73%**
R Squared (M)	**82.73%**

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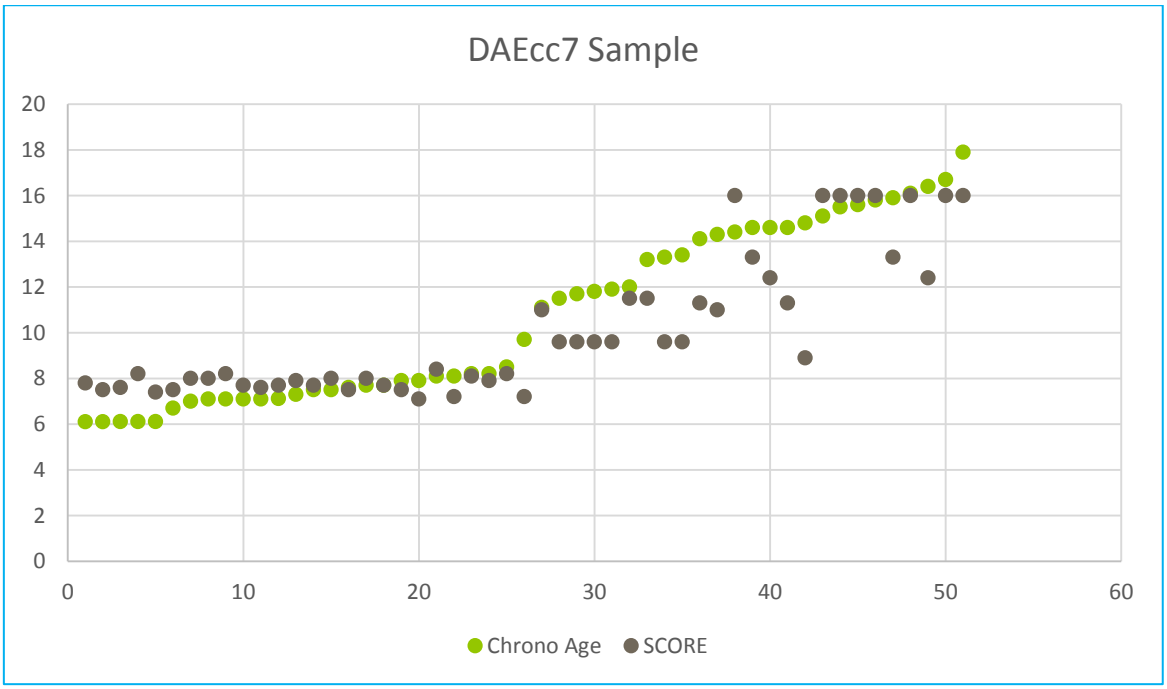
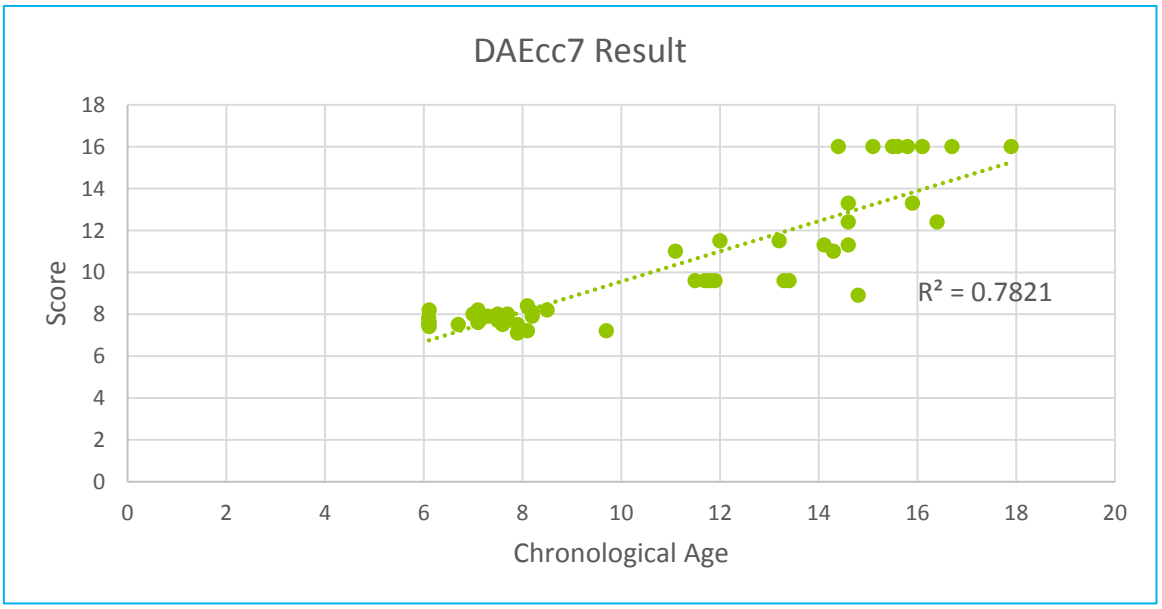


GRAPH 1- REPRESENTATION OF CHRONOLOGICAL AGE VERSUS SCORE Of DAEcc 7



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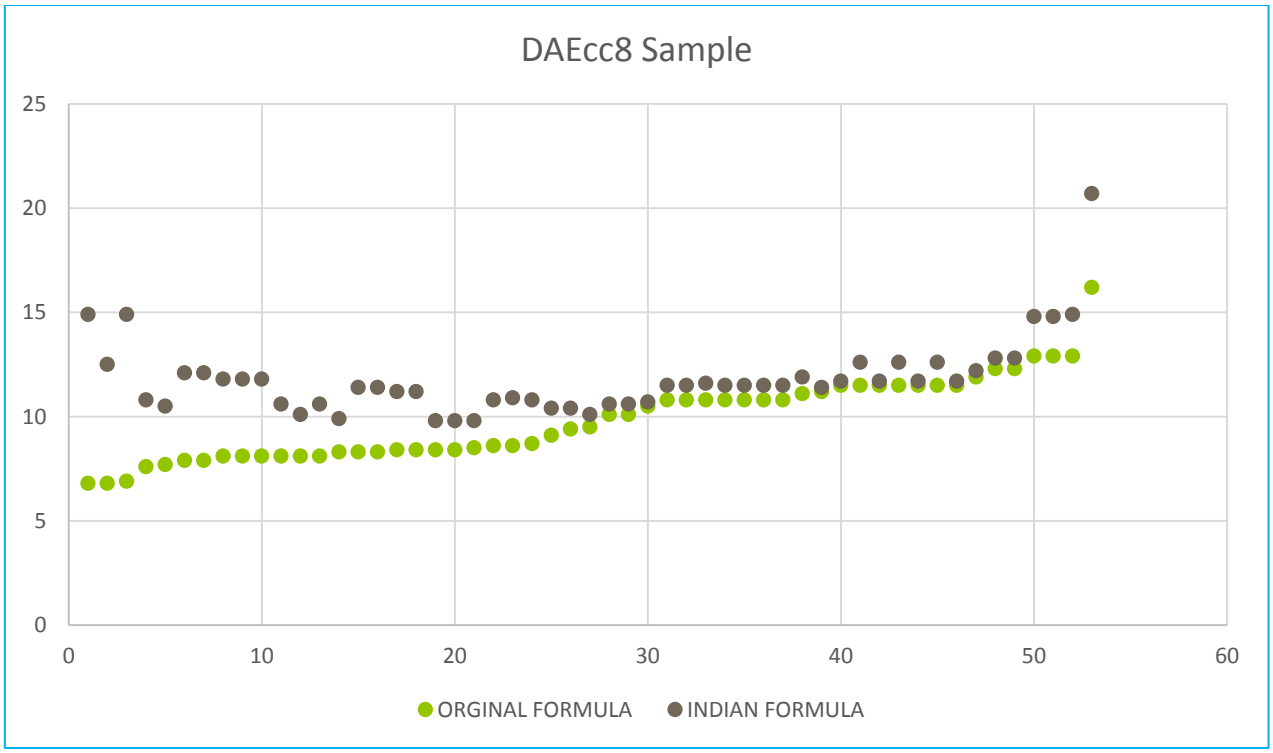
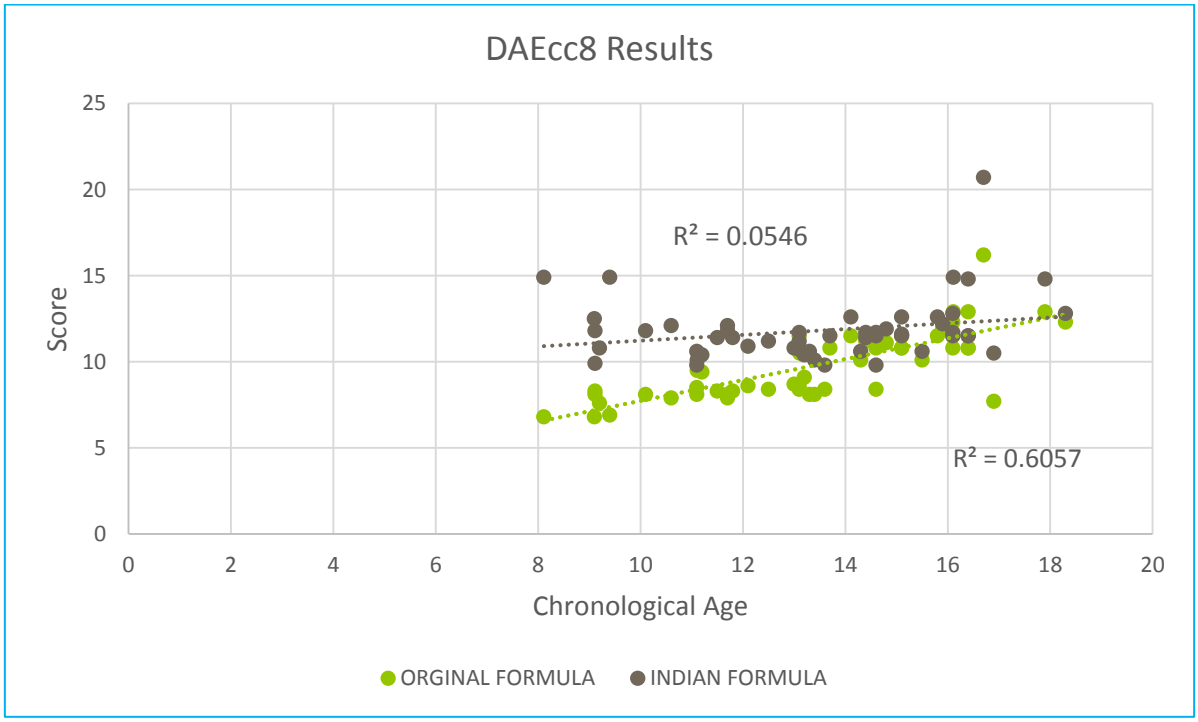
GRAPH 2 – REPRESENTATION OF R SQUARED VALUE SCHATTERED PLOT OF DAEcc 7



GRAPH 3 – REPRESENTATION OF DAEcc 8 SCATTERED PLOTING OF ORIGINAL FORMULA VERSUS INDIAN FORMULA



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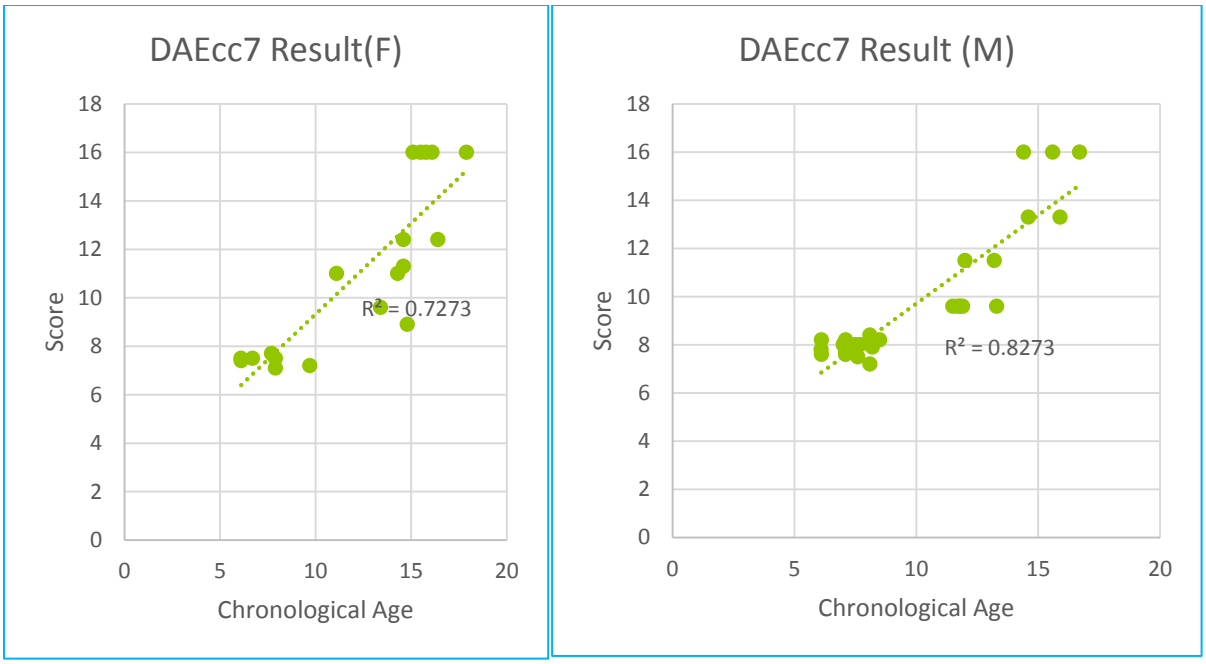
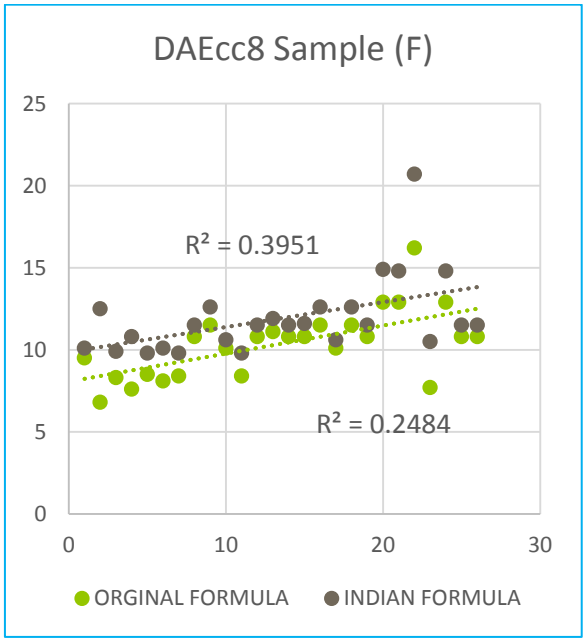
GRAPH 4 – REPRESENTATION OF R SQUARED VALUE IN DAEcc 8



GRAPH 4 AND 5 COMPARISION OF DAEcc 7 R SQUARED VALUE BETWEEN MALE AND FEMALE



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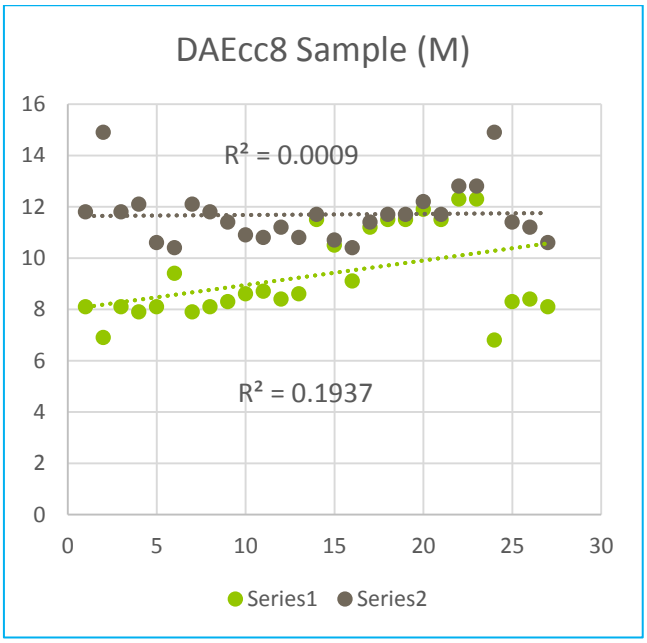

GRAPH 6 AND 7 - COMPARISION OF MALE AND FEMALE DAEcc8 R squared value

DISCUSSIONS

Dental Age estimation is more convenient and easier to perform over living/ deceased individual because of portable tools and easily accessible examination area of DAE there is no of transferring individual to mortuary or any Radiographic Centres . This helps to render services as early as possible to server law and justice.

The study talks about comparison of two methods of DAE 7th TOOTH AND 8th TOOTH OF DEMERJIAN, MODIFIED DEMERJIAN and comparison Indian formula and original Demerjian formula. It was found that original formula fits more approximate to the Gujarati population apart from Acharya's Indian formula.[XII] Even though there is a need of new Polynomial regression analysis with large number of samples. The 7th TOOTH DEMERJIAN method showed more accuracy over the 8TH TOOTH DEMERJIAN method of DAE. [x]

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The study conducted in Odisha to predict the accuracy of demerjian and modified Demerjian methods they have found new regression formula for their Demographic population. They have also found that girls show DAE over estimated Whereas boys show DAE Underestimated the chronological age. They
have taken age group 3- 18 total number of samples is 522.[IX]

Table I. Intra-observer and inter-observer correlation coefficient for reliability

Reliability	Methods		
	D	MD	AA
Intra (r value)	0.910-0.924	0.920-0.951	0.923-0.945
Inter (r value)	0.977-0.998	o.879-0.885	0.913-0.959*

The Study conducted in south Indian (Karnataka) population where it was compared clinical method of DAE to the Radiographic method. They have applied DAEcc 8th TOOTH method for radiographic evaluation. They have found that clinical method gives more accurate Age estimation nearly about the chronological age whereas the Radiographic method gives more variation from the Chronological age the studied also stated that there is a need of new polynomial regression formula for every Demographic region within the country. They have come up with new regression formula for the south Indian population. The sample size was 384, age group between 6- 21 years old. Similarly, the study was conducted in shiraz population of Iran where 158 in which 77male 81female subjects were choose to conduct the study all were healthy free from any dental anomalies they compared DA to CA. The results show the correlation coefficient between CA and DA in this study was 0.856 for boys, 0.891 for girls, and 0.854 for all subjects combined. They results tell that girls attain DA 9 months earlier than that of boys. Further they have categories the age into five groups where the results show.

Based on the Diff parameter, five groups were formed as follows:

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Group 1: The CA 1 to 2 years greater than the DA.

Group 2: The CA zero to 1 year greater than the DA.

Group 3: The DA zero to 1 year greater than the CA.

Group 4: The DA 1 to 2 years greater than the CA.

Group 5: The DA more than 2 years greater than the CA. [XII]

A study was conducted in Tamil Nadu where they have compared two methods of DAE Demerjian and weillemis method they had taken 3668 subjects for Demirjian and 3144 for Willems method they found the results as Demirjian produces the results overestimated and Willems produces the results underestimated Through the Meta-Analysis it was found that by The Willems method 40 days are underestimated.[XIII]

CONCLUSION The radiographic method is a non-invasive, easy and convenient method for DAE in every individual of any age, gender or living/deceased. Based on the study it is possible to conclude that the original Demirjian formula fits for the Gujarati population. There was a significant result obtained with a minimal error in the estimation . This could be further verified by conducting research on large no of samples. The DAEcc 7th TOOTH method showed more accuracy and feasibility since a particular chart needs to be compared with scores to obtain age. In comparison to the 8th TOOTH method, this could be used with a special consideration of the specific population groups.

FUTURE PROSPECTS

Large number of samples can be taken to represent the vast variety of demographics of the Gujarat. Individual groupings of age can be taken to have age specific data and regression formulae specifically. Individual gender-based groups can be made for better accuracy.

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