

Assessment of Applicability of Demirjian's Method for Dental Age Estimation

Dr. Sabita Shrestha¹, Dr. Komal Chand², Dr. Kajol Gurung³, Dr. Aashish Sigdel⁴, Dr. Kerishna Kansakar⁵

^{1,2,3,4,5}Intern, Kantipur Dental College
Teaching Hospital and Research Center,
Kathmandu, Nepal

Corresponding Author

Dr. Sabita Shrestha
Email: lusinastha@gmail.com

Citation

Shrestha S, Chand K, Gurung K,
Sigdel A, Kansakar K. Assessment of
Applicability of Demirjian's Method for
Dental Age Estimation. J Kantipur Dent
Coll. 2023;4(1): 27-30.

ABSTRACT

Introduction: Contemporarily importance of the dental age estimation has been increasing in diagnosis and treatment planning of orthodontic and pedodontics patients, forensic odontology, medico legal purposes as well as research associated with growth and development. Evaluation of dental age can be done by numerous methods, among which, Demirjian's method makes the use of orthopantomogram (OPG). OPGs are non-invasive and are commonly used for routine clinical examination.

Objectives: To assess the applicability of Demirjian's method for dental age estimation in age group (7-18) years.

Materials and methods: A cross-sectional study was carried out in the Department of Oral and Maxillofacial Pathology of Kantipur Dental College and Hospital, Kathmandu, Nepal. Digital OPGs were used, which were collected with consent from the Department of Oral Medicine, Diagnosis and Radiology. The permission to study was obtained from the Institutional Review Committee of Kantipur Dental College prior to conducting study. The patient's confidentiality were maintained. Intra-examiner assessment of the OPGs was done and the data were collected in Microsoft Excel sheet. Its analysis were performed in Statistical Package for the Social Sciences (SPSS).

Results: Mean and mean differences in chronological ages and dental ages were calculated, which revealed and overestimation of age in both males and females by 1.35 and 1.01 years respectively, which were statistically significant. When compared with chronological ages, there was an overestimation of age in all age group except 12, 13, 16, 17 and 18 years. Mean difference in age group (7-9) years were highly significant (p value <0.05), whereas, in age groups (10-18) years, it was not statistically significant.

Conclusions: Age estimation by Demirjian's method using Acharya's formula showed an overestimation of the dental age in the studied Nepalese population sample. The difference between the mean chronological ages and the dental ages was less significant in the age groups (11-18) years indicating greater applicability of this method in this age group.

Keywords: Age estimation; Demirjian's method; Dental age; Nepali children

INTRODUCTION

Age estimation carries great importance for forensic, medical as well as research purposes.¹ Various skeletal, dental and somatic indicators can be used for age estimation.² Among them, dental indicators are considered most reliable for age assessment because of the uniqueness of dental characteristics to each individual along with systematic, identifiable sequence of tooth development and eruption.^{3,4} Also, teeth are well-preserved parts of the body in long run.³

In this respect, Demirjian's method is one of the methods for dental age estimation, which is popular because of its simplicity, reproducibility and ease of standardization.⁵ Furthermore, digital OPGs, utilized in this method, are a dependable source since the developmental status of the

whole dentition can be assessed from a single radiograph and used for dental age estimation.⁶

Because of its simplicity, Demirjian's method has been widely used for dental age estimation in the Nepalese population as well. Acharya AB7 gave a formula for the age estimation in the South Indian population, which was developed on a sample of 165 males and 296 females aged 7 to 25 years. This study will use this formula for the estimation of dental age using the Demirjian's method in the children and adolescents of age group (7-18) years with aim to assess the applicability of Demirjian's method.

MATERIALS AND METHOD

A total of 156 sample OPG's of the patients with equal frequency of gender and age groups ranging from (7-18)

were collected with their consent from the Department of Oral Medicine, Diagnosis and Radiology of Kantipur Dental College and Hospital, Kathmandu, Nepal to conduct a cross-sectional study. The permission to study was obtained from the Institutional Review Committee of Kantipur Dental College prior to conducting study. The patient's confidentiality were maintained. The OPGs were taken from the same machine (CS900) by the same operator. The samples were collected and selected by one investigator on April 4th-7th, 2022. Radiographs were selected randomly but care was given so as to include equal number of OPGs for each sex in the individual age group for better assessment and relativity. The radiographs were then divided blindly among the other investigators, examined and the data (age at the time radiograph was taken; sex; tooth maturity score according to criteria of Demirjian's tooth development stage) were entered in Microsoft Excel and were analyzed from April 8th-11th, 2022. Intra-examiner reliability was tested.

The teeth in the third quadrant including third molar were examined and scored as Stage 0-9 according to the criteria of Demirjian's tooth development stage. Maturity scores were assigned to each tooth accordingly. Total maturity score was calculated and the dental age of the patient were calculated as per the formula given by Acharya AB for each sex.⁷ The estimated dental age were compared with the chronological age of the patient for assessment of the reliability of the Demirjian's method.

The data obtained were entered and analyzed on the SPSS V 20.0 software package. Descriptive statistics such as standard deviation and mean were used for dental age and chronological age. The difference between

chronological age and dental age was derived giving positive value representing overestimation and negative value representing underestimation of the age among two sexes and all age groups. Statistical tests were performed at 95% confidence level with SPSS V 20.0 software package.

Inclusion criteria

Healthy children of age ranging from (7-18) years (well developed and syndrome free) with properly recorded name, sex, age at the time OPG was taken and clear OPGs with no blurring, no artifacts.

Exclusion criteria

OPGs with blurring and or with artifacts present; poor quality OPGs; image deformation on left side of the mandible that prohibits the proper visualization and speculation of the tooth development; presence of dental abnormalities like hypodontia, congenitally missing left mandibular permanent teeth including left mandibular third molar, fracture due to trauma and presence of gross pathologies involving left mandible.

RESULT

Mean and mean differences in chronological age and estimated dental age were calculated, which revealed an overestimation of age in both males and females by 1.35 and 1.01 years respectively and an overestimation by 1.18 years as a whole where the mean chronological age for male was 12.54 years, for female was 12.46 years and for the whole group was 12.50 years and mean estimated dental age for male was 13.89 years, for female was 13.47 years and for the whole group was 13.68 years, which were statistically significant (Table 1; Fig.1).

Table 1: Comparison of mean chronological age and mean estimated dental age between genders

Gender	N	Chronological age		Dental Age		Difference			p-value
		Mean	SD	Mean	SD	CA	CI		
							Lower	Upper	
Male	78	12.54	3.37	13.89	2.58	-1.35	-2.00	-0.69	0.000
Female	78	12.46	3.47	13.47	2.79	-1.01	-1.48	-0.53	0.000
Total	156	12.50	3.46	13.68	2.68	-1.18	-1.58	-0.78	0.000

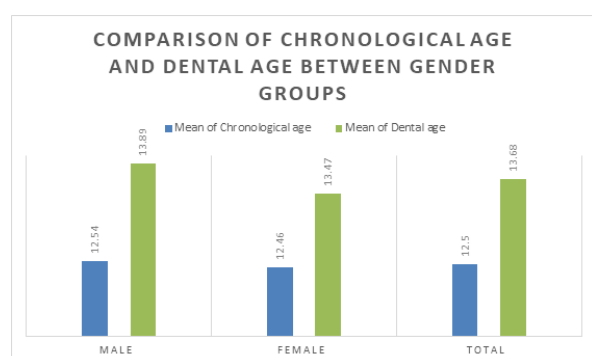


Fig.1: Bar Diagram representation of comparison of mean chronological age and mean estimated dental age between genders and as a whole

Mean and mean differences in chronological age and estimated dental ages in a specific age group including both male and female were calculated. When mean estimated dental ages were compared with mean chronological ages in a specific age group, there was an overestimation of age in all age groups except for age group 12, 13, 16, 17 and 18 years which had underestimation of age (Table 2; Fig.2).

Table 2: Comparison of mean chronological age and mean estimated dental age in all age groups

Age	N	Chronological Age		Dental Age		Difference			p-value
		Mean	SD	Mean	SD	CA	CI		
							Lower	Upper	
7	13	7	0.00	13.79	1.67	-6.79	-7.79	-5.78	0.000
8	13	8	0.00	12.08	1.91	-4.08	-5.23	-2.92	0.000
9	13	9	0.00	11.33	1.51	-2.33	-3.24	-1.42	0.000
10	13	10	0.00	10.97	1.07	-0.97	-1.61	-0.33	0.006
11	13	11	0.00	11.09	1.30	-0.09	-0.88	0.69	0.809
12	13	12	0.00	11.66	1.72	0.34	-0.69	1.38	0.489
13	13	13	0.00	12.67	1.58	0.33	-0.62	1.29	0.461
14	13	14	0.00	14.20	1.66	-0.19	-1.20	0.81	0.676
15	13	15	0.00	16.07	1.09	-1.07	-1.73	-0.41	0.004
16	13	16	0.00	15.97	1.16	0.03	-0.06	0.73	0.935
17	13	17	0.00	16.45	1.17	0.55	-0.16	1.26	0.117
18	13	18.00	0.00	17.84	0.77	0.16	-0.30	0.62	0.468

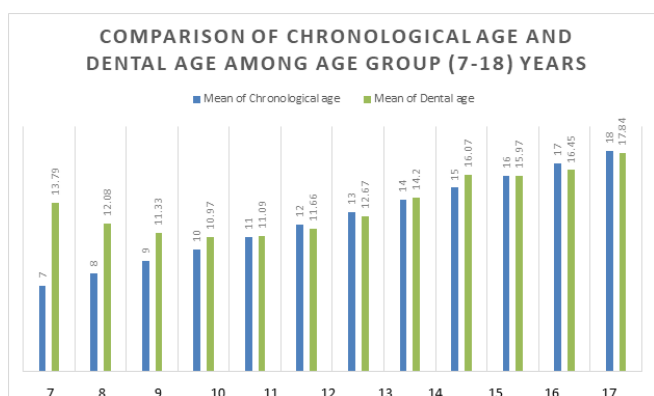


Fig.2: Comparison of mean chronological age and mean estimated dental age in all age groups

Mean difference in age groups (7-9) years were highly significant (p-value < 0.05) whereas, in age groups (10-18) years, it was not statistically significant.

DISCUSSION

Several methods has been developed over the period of time for speculation of dental age by analyzing several factors like anatomy, histology, sequence of tooth eruption and radiographs.⁵ No such method is present that is considered to be effective universally for calculating the dental age.⁵ Demirjian's method is one such method which was chosen for its easy application and utilization of radiograph showcasing the maturity of the permanent tooth. Though it is widely used it has not caught up with chronological age either positively or negatively in most populations of worldwide where the study was conducted using Demirjian's method.

The study we conducted consisted of OPGs of children aged (7-18) years with equal number of radiographs of each sexes in each age group which sufficed the sample size obtained for applying the Demirjian's method to estimate the dental age.

The estimated age when found to be overestimated meant that positive value was obtained when the chronological age was subtracted from the calculated dental age and likewise when estimated age was found to be underestimated meant that negative value was obtained.⁵ There was an overestimation of age using the Demirjian's method by 1.18 years in the whole group of children. Incidentally, most of the studies conducted in Nepal using Demirjian's method mostly resulted in negative value; that is underestimation of age.⁵ Studies conducted in the population around world like Turks, Malaysian, Bangladeshi, British, Croats, Brazilians, Indians and Spanish children had overestimation of age just like in our studies conducted in Nepali children.⁵

The overestimation was found to be more in male gender than in female gender in our study, where several literature has shown that female has evidently forward tooth development than in male.⁵

In the study conducted in the Indian population by Kiran *et. al.*, an underestimation of dental age was seen when original equation was used, whereas, the use of Acharya's formula resulted in an overestimated age by 1.72 years males and 1.91 years in the females; significant mean difference was seen between the chronological and dental age in all age groups except (14-16) years and (18-18.99).

Study conducted by Rinky Nyachhyon, in the age group (7-18) years, an underestimation of 0.82 years was seen in males and 1.17 years in females; whereas, an overestimation of 0.80 years and 0.25 years was observed in age groups of 7 and 9 years respectively, when the original equation was used.

CONCLUSION

Age estimation by Demirjian's method, using Acharya's formula showed an overestimation of the dental age in Nepalese children among which the overestimation of age was less significant in the age groups (11-18) years indicating greater applicability of Demirjian's method in this age group.



REFERENCES

1. Nyachhyon R. Evaluation of Dental Age in Nepali Children using Demirjian's 7-Teeth Teeth Method. *Orthod J Nepal*. 2018; 7(2):37-40.
2. Cugati N, Kumaresan R, Srinivasan B, Karthikeyan P. Dental age estimation of growing children by measurement of open apices: A Malaysian formula. *J Forensic Dent Sci*. 2015; 7:227-31.
3. Prabhakar AR, Panda AK, Raju OS. Applicability of Demirjian's method of age assessment in children of Davengere. *J Indian Soc Pedo Prev Dent*. 2002; 20(2):54-62.
4. Bijjaragi SC, Sangle VA, Saraswathi FK, Patil VS, Ashwini Rani SR, Bapure SK. Age estimation by modified Demirjian's method (2004) and its applicability in Tibetan young adults: A digital panoramic study. *J Oral Maxillofac Pathol*. 2015; 19(1):100-5.
5. Limbu S, Dikshit P, Malla M, Gautam U. Dental age estimation and accuracy assessment by Demirjian, Nolla and Willems methods in Nepalese children for predicting the chronological age. *Orthod J Nepal*. 2021 Dec. 31; 11(2):46-5.
6. Kapoor D. Age Estimation using Orthopantomogram and Willems Method in Chitwan Population. *JCMS Nepal*. 2018; 14(2):98-101.
7. Acharya AB. Age Estimation in Indians using Demirjian's 8-teeth Method. *J Forensic Sci*. 2011;56(1):124-127.
8. M. Puranik and S. R. Uma. Dental age estimation: a review. *Journal of Dental and Maxillofacial Research*. 2015; 1: p. 24.
9. Nykanen R, Espeland L, Kvaal SI, Krogstad O. Validity of the Demirjian method for dental age estimation when applied to Norwegian children. *Acta Odontol Scand*. 1998; 56:238-44.
10. Upadhyay S, Poudyal S, Khatiwada P, Khanal B, Shrestha S. Estimation of Dental Age by Demirjian and Willems Method in a Tertiary Care Hospital of Nepal. 2021; 11(1): 40-5.