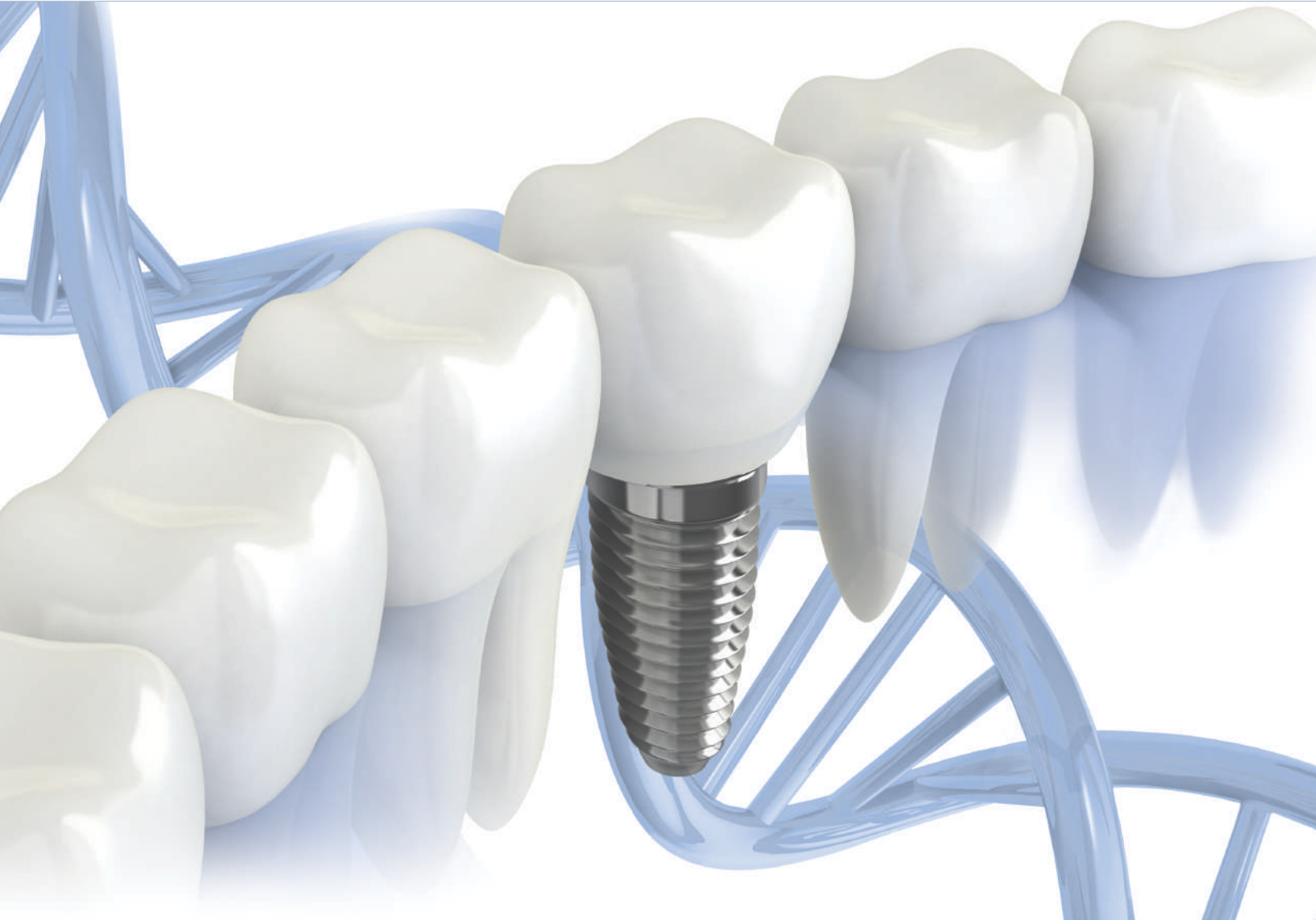




IJDR

Indian Journal of Dental Research

www.ijdr.in



Official Publication of

Indian Society for Dental Research
www.isdrindia.com

International Association for Dental Research - Indian Division
www.iadr.com

Validity of Nolla's Method for Age Estimation for Children in Kurdish Iraqi Population - A Retrospective Study

Abstract

Context: Radiographs have an essential role in Chronological Age (CA) estimation and are being used for dental age (DA) determination. **Aims:** Detecting the validity of Nolla's method (NM) for the age assessment of Kurdish Iraqi children (KIC). **Methods and Material:** A retrospective study was performed using orthopantomographs (OPGs) of 354 subjects aged from 4 to 13 years (178 boys and 176 girls) and their recording files. Subjects were divided into nine study groups: 4, 5, 6, 7, 8, 9, 10, 11, 12, and 13 years old. The chronological age (CA) was subtracted from the DA to find the validity of NM; the positive results indicated the overestimation of age, whereas the negative results indicated for underestimation. The data were recorded through a digitalised system using Microsoft Excel worksheet and analysed by Statistical Package for the Social Sciences (SPSS, version 25) programme using the dependent T-test and graphical analysis. The level of *P* value used in this study was set at < 0.05 . **Results:** The DA is underestimated in ages 9 to 13 in boys and girls. The highest difference in DA-CA was at the age of 9 years (-0.146 ± 0.162). **Conclusions:** NM for age estimation was slightly overestimated in age groups of 4, 5, 6, 7, and 8 years in boys and girls without statistically significant differences. However, this method underestimated the ages of KIC ranging from 9 to 13 years significantly.

Keywords: Age estimation in the living, forensic anthropology population data, Iraqi Kurdish population, Nolla; tooth development

Introduction

Nolla's method (NM) of age estimation is widely used in various regions of the world for the estimation of dental age (DA) and to achieve the chronological age (CA) from the DA.^[1,2] Age determination is carried out for different reasons such as in cases of crime, marriage, employment, and identifying victims in disasters, whereas no records about birth date are present.^[1-4] Radiographs have an essential role in age estimation.^[4-7] Numerous methods have been used to assess the DA from radiographs, which have been utilised from the degree of mineralisation of permanent teeth. DA estimation is mainly completed by methods including general physical examination, intraoral examination, and panoramic radiograph.^[5-7] The teeth are non-destructible and have the tiniest amount of turnover of their structure; hence, they can provide an important clue for the identification of people in forensic odontology.^[4] Nolla started to determine DA assessment using the radiological

appearances of maxillary and mandibular teeth.^[1-3] This study needed to estimate the DA of KIC in forensic dentistry. The aim of the study was to detect the validity of NM for the age assessment among KIC. The study hypothesised that NM could be effective among all age groups.

Subjects and Methods:

Method

The samples were collected through previously recorded panoramic radiographs of subjects who visited the radiology, diagnosis, and paedodontic departments at Tishk International University, Faculty of Dentistry. OPGs of children with the age ranging from four to 13 years, who had recording files in the Pedodontics Department, were selected in the present study. The ethical committee clearance reference number was (decree no. 6 on 26.10.2021).

A retrospective study was performed on panoramic radiographs of 1250 OPGs of subjects aged between four to 13 years. The age groups were studied by evaluating

**Bushra R. Noaman¹,
Adil O. Abdullah^{2,3}**

¹Department of Pedodontics, Dentistry Faculty, Tishk International University, Erbil, Kurdistan Region, Iraq, ²Endodontic Department, Dentistry Faculty, Tishk International University, Erbil, KRG, Iraq, ³Dental Assistant Department, Erbil Medical Technical Institute, Erbil Polytechnic University, Erbil, Kurdistan Region, Iraq

Address for correspondence:

Dr. Bushra R. Noaman,
Tishk International University,
Erbil 44001, Kurdistan Region,
Iraq.
E-mail: Bushra.rashid@tiu.edu.iq

Received : 19-12-2021

Revised : 19-08-2022

Accepted : 10-10-2022

Published : 30-03-2023

Access this article online

Website: www.ijdr.in

DOI: 10.4103/ijdr.ijdr_1181_21

Quick Response Code:



How to cite this article: Noaman BR, Abdullah AO. Validity of Nolla's method for age estimation for children in Kurdish Iraqi population - A retrospective study. Indian J Dent Res 2022;33:393-6.

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

radiographs and the recording files of the same children. The children included in the study were only Kurdish individuals who had complete recordings. Foreign nationalities other than Kurdish Iraqi were excluded from the study. Children with diseases that can affect the development of teeth such as ectodermal dysplasia, vitamin D or calcium deficiencies, and hormonal diseases were also excluded. Unclear OPGs or individuals showing congenitally missing teeth were excluded from the study.

The sample of this study, after considering the selection criteria, consisted of 354 OPGs of healthy Kurdish children (178 boys and 176 girls) aged between four to 13 years. Samples were divided into nine study groups.

The CA of each child was calculated by subtracting the date of birth from the date of the radiographic examination and used to compare the calculated DA according to NM. The stage of dental calcification from the radiograph was estimated for each tooth in the left lower teeth for each child according to NM of DA estimation. To find the accurate dental age of each subject, the DA compared with his or her CA. The CA is subtracted from the DA; if the result was positive, it indicated for overestimation of age, whereas negative results indicated underestimation.

Then, the total sum was compared with the table described by Nolla for boys and girls to find the DA. Figure 1 shows the stages of calcification calculated for seven lower teeth, and then the summation of the scores was made. The results were compared to Nolla's table of girls without wisdom teeth and DA was obtained. The data were recorded using a digitalised system using Microsoft Excel worksheet and analysed by the Statistical Package for the Social Sciences (SPSS, version 25) programme using the dependent T-test and graphical analysis. The *P* value used in this study was set at <0.05.

Figure 1 shows the scoring of DA according to NM.

Results

Table 1 shows the distribution of samples according to age and gender. Total samples were evaluated and included 354 OPGs of children aged between 4 and 13 years. The samples were 178 boys and 176 girls (50.3% and 49.7%, respectively).

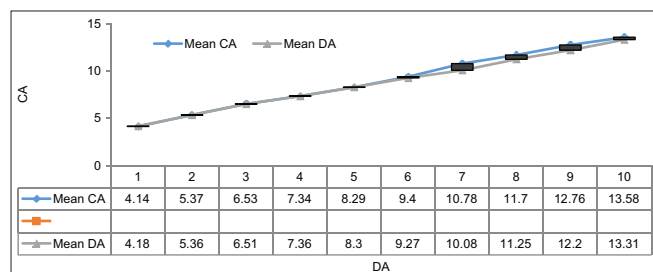


Figure 1: NM to determine the relation between chronological ages and dental ages for boys

Table 2 and Figure 2 demonstrate the differences among boys between the CA and DA according to NM. The difference between DA and CA in age groups 4, 5, 6, 7 and 8 years was non-significant (0.04 ± 0.2302 , -0.007692 ± 0.1188 , -0.003226 ± 0.1378 , 0.01875 ± 0.2420 and 0.003448 ± 0.2129 , respectively). The difference between DA and CA was highly significant in age groups 10, 12, and 13 years (-0.4091 ± 0.3048 , -0.5667 ± 0.3327 and -0.2700 ± 0.2058 , respectively).

Figure 1 illustrates the relation between chronological ages and DAs determined by NM for boys. From the graph, it can be seen that CA and DA lines increased together steadily in ages 4, 5, 6, 7, and 8 years. Starting from the 9 years, the line of CA is more advanced than the DA line in ages nine, ten, eleven, twelve, and thirteen.

Table 3 demonstrates the differences in girls between the CA and DA according to NM. The difference between DA and CA in age groups 4, 5, 6, 7 and 8 years was non-significant (0.040 ± 0.260 , 0.020 ± 0.174 , 0.029 ± 0.141 , 0.028 ± 0.225 and 0.081 ± 0.166 , respectively). However, the difference between DA and CA was significant in age groups. The DA in ages between 9 and 13 years were underestimated in girls.

Figure 2 illustrates the relation between CA and DA determined by NM for girls. It can be noticed that both CA and DA increase together steadily and in the same line for ages 4, 5, 6, 6, 7 and 9 nine years. However, the line of CA increases more than the DA in ages 9, 10, 11, 12 and 13.

Discussion

The establishment of DA is one of the dependable indicators of CA and is mostly used in forensic and legal dentistry.^[8] The maturity of dentition provides predictable information about proper treatment planning, especially in paediatric dentistry and orthodontics.^[9] Nolla^[10] reported that the DA value of one side represents the development in both the maxilla and mandible, besides reporting that the DA or development age representing the physiologic age and knowing the DA of a child is extremely important for the orthodontist because the orthodontist needs the physiologic age to decide when the treatment should be started.

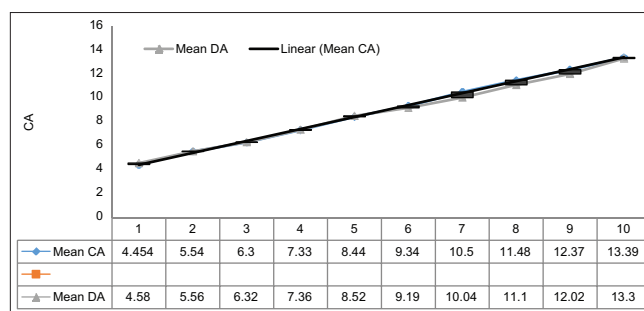


Figure 2: Relation between chronological ages and dental ages determined by NM for girls

Table 1: Distribution of the sample according to age and gender

CA	Boys/n	Girls/n	Total/n
4-4.9	5	5	10
5-5.9	25	16	41
6-6.9	34	33	67
7-7.9	48	39	87
8-8.9	30	12	42
9-9.9	27	28	55
10-10.9	11	12	23
11-11.9	14	13	27
12-12.9	6	8	14
13-13.9	10	10	20
Total %	54.4	45.6	386

Table 2: Differences between chronological ages and dental ages determined by NM for boys

Age	Mean CA	Mean DA	DA-CA	P
4-4.9	4.14±0.10	4.18±0.27	0.04±0.2302	0.7174
5-5.9	5.37±0.31	5.36±0.38	-0.00769±0.1188	0.8193
6-6.9	6.53±0.62	6.51±0.23	-0.0032±0.1378	0.8972
7-7.9	7.34±0.23	7.36±0.28	0.0187±0.2420	0.5940
8-8.9	8.29±0.21	8.3±0.33	0.003448±0.2129	0.9311
9-9.9	9.40±0.27	9.27±0.29	-0.1296±0.1540	0.0002***
10-10.9	10.78±0.33	10.08±0.20	-0.4091±0.3048	0.0012**
11-11.9	11.70±0.18	11.25±0.31	-0.4500±0.3179	0.0001***
12-12.9	12.76±0.11	12.2±0.22	-0.5667±0.3327	0.0087**
13-13.9	13.58±0.29	13.31±0.27	-0.2700±0.2058	0.0025**

$P < 0.05$. * Significant **highly significant***very high significant

Table 3: Differences between mean chronological ages and mean dental ages determined by NM for girls

Age	Mean CA	Mean DA	DA-CA	P
4-4.9	4.454±0.33	4.58±0.14	0.040±0.260	0.7489
5-5.9	5.54±0.34	5.56±0.35	0.020±0.174	0.6631
6-6.9	6.30±0.29	6.32±0.35	0.029±0.141	0.2636
7-7.9	7.33±0.24	7.36±0.30	0.028±0.225	0.4334
8-8.9	8.44±0.30	8.52±0.35	0.081±0.166	0.1337
9-9.9	9.34±0.25	9.19±0.26	-0.146±0.162	0.0001***
10-10.9	10.50±0.23	10.04±0.13	-0.466±0.344	0.0007***
11-11.9	11.48±0.21	11.10±0.19	-0.372±0.300	0.0021**
12-12.9	12.37±0.28	12.02±0.06	-0.350±0.3024	0.0136*
13-13.9	13.39±0.26	13.3±0.28	-0.090±0.07379	0.0039**

$P < 0.05$. *Significant **highly significant***very high significant

Several methods had been used to determine the DA in many populations.^[8,11,12] NM consists of ten stages of tooth calcification.^[8] Many researchers^[6,13,14] ordinarily use it over Demirjian's method^[11] because NM had two extra stages of calcification.^[14] NM had more accurate results for age assessment than other methods as reported by many researchers.^[6,13,14] Therefore, researchers in this study selected NM to implement it in forensic dentistry for the age determination of children in the Kurdish Iraqi population.

It has been reported in many research studies that the DA in children is different between geographic areas in the same country.^[14,15] The Kurdistan region has a different geographic land and weather than other parts of Iraq; therefore, the study opted for the Kurdish children. In Turkey, studies have been conducted to assess the validity of NM for age estimation in the western, northeastern, and eastern parts of Turkey;^[5,6,14] the results were different between the three regions.

In this study, the results showed an underestimation of the ages of children aged from 9, 10, 11, 12, and 13 years old for both boys and girls with highly significant differences. Jia *et al.*^[16] reported that NM underestimated the age of girls and boys of all ages in the Turkish population. In the Spanish population, Bolanos *et al.*^[8] stated that tooth numbers 21, 46 and 43 for boys and 21, 47 and 46 for girls under ten years of age could evaluate the DA by NM. Altunsoy^[14] concluded that NM was suitable for western Turkish in determining the age of the children except in boys aged 10, 11 and 12 and girls aged 7, 8, 9, 10 and 11 years. Miloglu *et al.*^[5] found that this method had underestimated DA for eastern Turkish children, whereas Nur^[6] found that NM underestimated the DA of children in northeastern Turkey. In this study, NM underestimated the DA of Kurdish children of different ages including 9, 10, 11, 12 and 13 in girls. For boys, NM underestimated the age of children of 9, 10, 11, 12 and 13 years. There was an overestimation for ages 4, 5, 6, 7 and 8 years in both boys and girls; however, there was no significant difference between the CA and DA in these age groups.

According to the current study and within the limitations of the study, NM is valid to use for age determination in the Kurdish Iraqi population aged 4, 5, 6, 7 and 8 years, and it is not valid for age estimation for 9, 10, 11, 12 and 13 years in both boys and girls. Therefore, the study hypothesis is partially accepted.

Acknowledgements

The authors acknowledge Tishk International University for helping them by providing the radiographs for this study.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

- Melo M, Ata-Ali J. Accuracy of the estimation of dental age in comparison with chronological age in a Spanish sample of 2641 living subjects using the Demirjian and Nolla methods. *Forensic Sci Int* 2017;270:276-7.
- Lopes LJ, Nascimento HAR, Lima GP, Santos LAND, Queluz DP, Freitas DQ. Dental age assessment: Which is the most applicable method? *Forensic Sci Int* 2018;284:97-100.
- Yassin SM, AlAlmai BAM, Ali Huaylah SH, Althobati MK,

- AlHamdi FMA, Togoo RA. Accuracy of estimating chronological age from Nolla's method of dental age estimation in a population of southern Saudi Arabian children. *Niger J Clin Pract* 2020;12:1753-8.
4. Panchbhai AS. Dental radiographic indicators, a key to age estimation. *Dentomaxillofac Radiol* 2011;4:199-212.
 5. Miloglu O, Celikoglu M, Dane A, Cantekin K, Yilmaz AB. Is the assessment of dental age by the Nolla method valid for eastern Turkish children? *J Forensic Sci* 2011;4:1025-8.
 6. Nur B, Kusgoz A, Bayram M, Celikoglu M, Nur M, Kayipmaz S, *et al.* Validity of demirjian and nolla methods for dental age estimation for Northeastern Turkish children aged 5-16 years old. *Med Oral Patol Oral Cir Bucal* 2012;5:871-7.
 7. Ercalikyalcinkaya S, Dumlu A, Bekiroglu N, Kizilyel G, Kargul B. Demirjian's system for estimating dental age among Northwestern Turkish children aged 4-16 years. *Eur J Paediatr Dent* 2013;3:225-30.
 8. Bolanos MV, Manrique MC, Bolanos MJ, Briones MT. Approaches to chronological age assessment based on dental calcification. *Forensic Sci Int* 2000;2:97-106.
 9. Sisman Y, Uysal T, Yagmur F, Ramoglu SI. Third-molar development in relation to chronologic age in Turkish children and young adults. *Angle Orthod* 2007;6:1040-5.
 10. Nolla CM. The Development of Permanent teeth. Diss. University of Michigan, 1952.
 11. Willems G, Van Olmen A, Spiessens B, Carels C. Dental age estimation in Belgian children: Demirjian's technique revisited. *J Forensic Sci* 2001;4:893-5.
 12. Demirjian A, Goldstein H, Tanner JM. A new system of dental age assessment. *Hum Biol* 1973; 2:211-27.
 13. Maber M, Liversidge HM, Hector MP. Accuracy of age estimation of radiographic methods using developing teeth. *Forensic Sci Int* 2006;1:68-73.
 14. Altunsoy M, Nur BG, Akkemik Ö, Ok E, Evcil MS. Dental age assessment: Validity of the Nolla method in a group of western Turkish children. *Marmara Dent J* 2013;1:49-52.
 15. Celikoglu M, Erdem A, Dane A, Demirci T. Dental age assessment in orthodontic patients with and without skeletal malocclusions. *Orthod Craniofac Res* 2011;2:58-62.
 16. Jia SX, Han MQ, Wang CX, Mou QN, Zhao JM, Chen T, *et al.* Accuracy of Nolla method for age estimation of Northern Chinese Han Children. *Fa Yi Xue Za Zhi* 2021;2:181-6.