European Journal of Molecular & Clinical Medicine

ISSN 2515-8260 Volume 9, Issue 7, Summer 2022

ORIGINAL RESEARCH

Age estimation by Drusini's method and Jeon's method in Indian population- an original research

[1]Dr. Kailash Chandra Dash, [2]Dr. Kala Bagavathy, [3]Dr Shipha Hegde, [4]Dr. Dheeraj Voulligonda, [5]Dr. Sheik Sameerudeen, [6]Dr. Alok Dubey, [7]Dr. Nannuri Viswa Samtha

[1]Reader, Department of Oral and Maxillofacial Pathology, Kalinga Institute of Dental Sciences, Kalinga Institute of Industrial Technology (KIIT) Deemed to be University, Bhubaneswar, Odisha, India
[2]MDS, Senior Lecturer, Department of Oral and Maxillofacial Surgery, Rajas Dental College, Kavalkinaru, Tamil Nadu, India
[3]Lecturer, Nitte (Deemed to be University), AB Shetty Memorial Institute of Dental Sciences (ABSMIDS), Department of Prosthodontics and Crown and Bridge, Mangalore, India
[4]Reader, Department of Oral Medicine and Radiology, Mamata Institute of Dental Sciences, Hyderabad, Telangana, India
[5]BDS, MDS, Consultant Oral and Maxillofacial surgeon, MSM Dental and maxillofacial centre, Adirampattinam, Tamilnadu, India
[6]Associate Professor, Department of Preventive Dental Sciences, College of Dentistry, Jazan University, Jazan, Saudi Arabia
[7]MBBS, Program Officer, Rashtriya Bal Swasthya Karyakram and Non Communicable Disease, District Medical and Health Office, Visakhapatnam, Andhra Pradesh, India

Correspondence:
Dr Shipha Hegde
Lecturer, Nitte (Deemed to be University), AB Shetty Memorial Institute of DentalSciences (ABSMIDS), Department of Prosthodontics and Crown and Bridge, Mangalore, India
Email: shiphahegde@gmail.com

Received: 22 September, 2022 Accepted: 27 October, 2022

ABSTRACT

Aim: To assess and compare age estimation by Drusini's method and Jeon's method and correlate chronological age and age estimation by both the methods in Indian Adults.

Methodology: Two hundred intraoral periapical radiovisuographs of the patients aged 20–69 years with optimum diagnostic quality radiographic images of permanent mandibular first molars were selected from the digital archive of the Department of Oral Medicine Diagnosis and Radiology from the dental college. Measurements were done using Drusini's and Jeon's methods and compared with the chronological age. A $P < 0.05$ was considered statistically significant. Analysis of variance followed by Tukey's *Post hoc* test, *t*-test.

Results; Mean chronological age, estimated using Jeon's method and estimated by Drusini's method, was 30.77 ± 9.32, 29.790 ± 7.729 and 27.885 ± 8.190, respectively. This difference was statistically highly significant, whereas Jeon's method showed a strong positive correlation between chronological age and age.

Conclusion: The study concludes that Jeon's method is more accurate than Drusini's in the Indian population.

Keywords: Age estimation, chronological age, Drusini's method, Indian adults, intraoral periapical radiovisuographs, Jeon's method

INTRODUCTION

The human body grows and matures with age, especially in children and adolescents. Therefore, the main idea behind the various methods of age estimation is to compare the measurements of physical maturity of the body with age. However, due to individual variations in the timing of skeletal and dental development, the results of any method are subject to uncertainty when applied to a single individual. There are also issues related to the relevance and representativeness of the available reference populations. There exist several methods and a fairly substantial literature on the field. However, there will always be biological variations and uncertainty associated with age estimates. From a statistical-methodological point of view, there are reasons to believe that a combination of different measurement methods and a more conscious use of the relevant statistical methodology may provide more reliable estimates and better quantification of associated levels of uncertainty. The dental age estimation has a significant role in forensic investigations and in clinical applications to determine the degree of maturation in children and adolescents.[1] The most commonly used methods for dental age estimation are based on the radiographic analysis of developing teeth.[2,3] The advantages like ease of use and the noninvasive technique of interpretation made the radiographic methods more appropriate for dental age estimation.[4] The Demirjian method using the calcification stages of mandibular left seven teeth is the most widely used radiographic method of dental age estimation.[5] The representation of each developmental stage with illustrations and line diagrams made the Demirjian method widely accepted.[1,6] In the Willems method, the tiresomestep of converting maturity score to dental age was omitted to make it simpler, yet retaining the advantages of the Demirjian technique. The dental age estimation by using the maxillary and mandibular teeth were developed by Haavikko. In the Haavikko method, age estimation is based on the determination of 1 of 12 radiographic stages (six relating to the crown formation and six relating to root formation, with stage "O" allocated for the appearance of a crypt of a tooth) of incisor to second molars in the maxilla and mandible.[7]The technique developed by Ikeda et al.was applied by Drusini et al.[8] Jeon et al. derived an equation based on pulp chamber floor height ratio (F/L), pulp chamber ceiling height ratio, roof height ratio (R/L) and pulp chamber depth ratio (D/L).[9]Anterior teeth used for recent age estimation methods are absent in the elderly Indian population.[10] Although various dental age estimation methods revealed a high degree of accuracy and reliability specific to a population group, ethnic differences between various population groups are found to affect the accuracy and reliability of different dental age estimation methodologies.[11] However, the concept of ethnic variability in dental age estimation methods is still unclear, as the reports of testing ethnic variability in dental age estimation have come with no significant results. In such a context, India is a unique country with variable ethnicities; there is always a need to evaluate the applicability of different dental age estimation methods in different ethnic groups of the Indian population.[12] Though various studies have been done to estimate the dental age in different parts of India, a similar assessment has been found lacking in evaluating the applicability of dental age estimation methods in different ethnic groups of India.

AIM OF THE PRESENT STUDY

This study aimed to assess and compare age estimation by Drusini's method and Jeon's method and correlate chronological age and age estimation by both the methods in Indian Adults.

METHODOLOGY

This cross-sectional study was conducted after obtaining relevant permissions from Scientific Advisory Committee and Institutional Ethics Committee. The study was conducted over 2 months. Radiovisuographs of individuals aged between 20 and 69 clearly showing the sound permanent mandibular first molar. Two hundred IOPRs of the patients aged 20–69 years with optimum diagnostic quality radiographic images of permanent mandibular first molars were selected from the digital archive. For Drusini's method,[7] we considered mandibular first molars. Two observers independently recorded the measurements (in mm) of the length of the crown length and length of the coronal pulp cavity on the radiovisuographs, using a digital calliper to the nearest 0.01 mm. Using the mean of the two measurements, the tooth-coronal index (TCI) for each tooth was then calculated. In Jeon's method,[11] four distances were measured using specific reference points and recorded in mm on the radiographs. The reference points were namely:

1. The roof of the pulp chamber
2. The floor of the pulp chamber
3. The highest point on the root furcation
4. The start point of the lingual groove.

The distance between the floor of the pulp chamber and the highest point on the root furcation was recorded as "F." The distance between the roof of the pulp chamber and the highest point on the root furcation was recorded as "R." The distance from the start point of lingual groove to the highest point on the root furcation was recorded as "L" and the depth of the pulp chamber was recorded as "D (R minus F)". The following ratios were calculated: pulp chamber (F/L), pulp chamber (R/L) and pulp chamber (D/L). Comparison of mean differences of actual age versus age determined by Jeon's method and Drusini's method between the three age groups was done using one-way analysis of variance (ANOVA) followed by Tukey's *post hoc* test. Comparison of mean differences of actual age versus age determined by Jeon's method and Drusini's method between gender was done using *t*-test. $P < 0.05$ was considered to be statistically significant.

RESULTS

The study involved 200 radiographs, of which 95 radiographs were of males and 105 were of female patients. According to their age, they were grouped into three subsets, namely <25 years, 25–40 years, >40 years. There were radiographs of 66 individuals, 103 individuals and 31 individuals in the age groups of <25 years, 25–40 years and >40 years, respectively. The mean chronological age was found to be 30.775 ± 9.329. The mean age estimated using Jeon's method is 29.790 ± 7.729, and the mean age estimated by Drusini's method is 27.885 ± 8.190. (Table 1)

Table 1-Descriptive statistics (mean and standard deviation) of the parameters in the study

Parameter	Minimum	Maximum	Mean±SD
Chronological age	20.00	62.00	30.77±9.32
Age estimation by Jeon's method	18.79	56.07	29.79±7.72
Age estimation by Drusini's method	7.81	57.39	27.88±8.19

**SD: Standard deviation*

Using one-way ANOVA and Inter-group comparison of the difference of age estimation by Jeon's method and Drusini's method between the three age groups was statistically highly significant.($P < 0.01$). There was no significant difference in age between chronological age and age estimated by Jeon's method ($P = 0.474$). In contrast, there was a considerable difference between chronological age and age estimated using Drusini's method ($P = 0.002$). It was also found that there was no significant difference between age calculated using Jeon's

method and Drusini's method (P = 063). There was a strong positive correlation between chronological age and age estimated by Jeon's method (r =0.969, P = 0.000). There was a weak positive correlation between Chronological age and age estimated by Drusini's method (r =0.399, P = 0.000). (Table 2)

Table 2- Pair wise comparison of the difference in age estimated by Jeon's method and Drusini's method versus actual age

	Chronological age	**Age estimation by Jeon's method**	**Age estimation by Drusini's method**
Chronological age Pearson correlation	1	0.969**	0.399**
P	-	0.000	0.000
Age estimation by Jeon's method Pearson correlation	0.969**	1	0.392**
P	0.000	-	0.000
Age estimation by Drusini's method Pearson correlation	0.399**	0.392**	1
P	0.000	0.000	-

**correlation and P value is significant at the 0.01 level (two -tailed)*

DISCUSSION

The variability of maturation standards in different ethnic groups suggests the need for ethnic-specific dental age estimation methodologies around the world. The Indian population consists of multiple ethnic, linguistic variable population groups, that further warrant the evaluation of different dental age estimation methodologies around different regions of the Indian subcontinent. The most reliable and feasible method to evaluate age estimation using teeth is chronological age estimation.[9] Reduction in size of the pulp chamber is one of the noninvasive features best known for aging.The deposition of secondary dentin was age-related, was pointed out by Bodeckerin 1925.[10] Secondary dentin deposition is a continuing, regular process, which is least influenced by other environmental factors. One of the best indicators of age could be a reduction in pulp cavity size due to secondary dentin deposition. These changes were best analyzed on radiographs; thus, various methods were proposed. Several radiological age estimation methods were based on orthopantomogram (OPG).Limitations of OPG are lack of detailing and the projection can be taken at only one angle. This affects the quality of the measurements performed, thus affecting the calculated age's accuracy. The present study revealed that there is a gender difference in TCI. This study's result agrees with Agematsu et al.in Japan; Igbigbi and Nyirendain Malawi, who mentioned a need for sex-specific formulae in the sampled population since gender has a significant role influence on age estimation using TCI. The gender-based difference was explained by the impact of estrogen on secondary dentin formation.[14] Hietala et al.[15]and Silvana et al.[16]reported that estrogen receptors existed in the odontoblast of human pulp tissues. In addition, Yokose et al.[17]reported that estrogen deficiency promotes the substrate synthesis of odontoblast. In the present study, we chose the side on which the pulp chamber was more visible. The corresponding tooth of the other side was selected for measurement in cases of tooth malpositioning, tilting or overlapping and/or if insufficient tooth information was available.Our study demonstrated that the side from which the tooth was chosen had negligible impact on radiographic age estimation, which is in accordance with other studies done in Italy by Drusini,[18]Drusini et al.,[19] Zadzinska et al.,[20]in Malawi by Igbigbi and Nyirenda,[21]in India by Saxena,in Egypt by Khattab et al.,[22]in Western Australia by Karkhanis

et al.[23] There is a positive correlation between TCI in the current study and age. The correlation is more in females than males, i.e., the index increases with increasing age.

CONCLUSION

The results demonstrated that Jeon's approach is more accurate than TCI in the Indian population. As in Jeon's method, the derived equation was used to estimate the ages, the technique is less time consuming, conducive and newer in the Indian population.

REFERENCES

1. Demirjian A, Goldstein H. A new system of dental age assessment. Hum Biol 1973;45(2):211–227.
2. Maber M, Liversidge HM, Hector MP. Accuracy of age estimation of radiographic methods using developing teeth. Forensic Sci Int 2006;159(1):68–73. DOI: 10.1016/j.forsciint.2006.02.019.
3. Moorrees CF, Fanning EA, Hunt EE. Age variation of formation stages for ten permanent teeth. J Dent Res 1963;42:1490–1502. DOI: 10.1177/00220345630420062701.
4. Panchbhai AS. Review dental radiographic indicators, a key to age estimation. Dentomaxillofac Radiol 2011;40(4):199–212. DOI: 10.1259/dmfr/19478385.
5. Koshy S, Tandon S. Dental age assessment: the applicability of Demirjian's method in South Indian children. Forensic Sci Int 1998;94(1–2):73–85. DOI: 10.1016/S0379-0738(98)00034-6.
6. Willems G. A review of the most commonly used dental age estimation techniques. J Forensic Odontostomatol 2001;19(1):9–17.
7. Butti AC. Haavikko's method to assess dental age in Italian children. Eur J Orthod 2009;31(2):150–155. DOI: 10.1093/ejo/cjn081.
8. Ikeda N, Umetsu K, Kashimura S, Suzuki T, Oumi M. Estimation of age from teeth with their soft X-ray findings. Nihon Hoigaku Zasshi 1985;39:244-50.
9. Jeon HM, Kim JH, Heo JY, Ok SM, Jeong SH, Ahn YW. Age estimation by radiological measuring pulp chamber of mandibular first molar in Korean adults. Journal of Oral Medicine and Pain 2015;40:146-54.
10. Mathew DG, Rajesh S, Koshi E, Priya LE, Nair AS, Mohan A. Adult forensic age estimation using mandibular first molar radiographs: A novel technique. Journal of forensic dental sciences 2013;5:56.
11. Willems G, Olmen AV, Spiessens B, et al. Dental age estimation in Belgian children: Demirjian's technique revisited. J Forensic Sci 2001;46(4):893–895. DOI: 10.1520/JFS15064J.
12. Papiha SS. Genetic variations in India. Hum Biol 1996;68(5):607–628.
13. Willems G, Moulin-Romsee C, Solheim T. Non-destructive dental-age calculation methods in adults: Intra- and inter-observer effects. Forensic Sci Int 2002;126:221-6.\
14. Agematsu H, Someda H, Hashimoto M, Matsunaga S, Abe S, Kim HJ, et al. Three-dimensional observation of decrease in pulp cavity volume using micro-CT: Age-related change. Bull Tokyo Dent Coll 2010;51:1-6.
15. Hietala EL, Larmas M, Salo T. Localization of estrogen-receptor-related antigen in human odontoblasts. J Dent Res 1998;77:1384-7.
16. Jukić S, Prpić-Mehicić G, Talan-Hranilovć J, Miletić I, Segović S, Anić I. Estrogen receptors in human pulp tissue. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2003;95:340-4. doi: 10.1067/moe.2003.9. PMID: 12627107
17. Yokose S, Zhungfeng C, Tajima Y, Fujieda K, Katayama I, Katayama T. The effects of estrogen deficiency on glycosylation of odontoblasts in rats. J Endod 1998;24:645-7.

18. Drusini AG, Toso O, Ranzato C. The coronal pulp cavity index: A biomarker for age determination in human adults. Am J Phys Anthropol 1997;103:353-63.
19. Drusini AG. The coronal pulp cavity index: A forensic tool for age determination in Juman adults. Quad Med Forense 2008;14:235-49.
20. Zadinska E, Drusini AG, Carrara N. The comparison between two age estimation methods based on human teeth. Przeglad Antrpologiczny Anthropol Rev 2000;63:95-101.
21. Shrestha J. Comparative evaluation of two established age estimation techniques (two histological and radiological) by image analysis software using single tooth. Forensic Res 2014;5:1-6.
22. Khattab NA, Marzouk HM, Wahab A. Application of tooth coronal index for age estimation among adult Egyptians. Sch Res 2013;15:32-40.
23. Karkhanis S, Mack P, Franklin D. Age estimation standards for a Western Australian population using the coronal pulp cavity index. Forensic Sci Int 2013;231: 6.e1-6.