Quest Journals
Journal of Medical and Dental Science Research
Volume 9~ Issue 5 (2022) pp: 01-05
ISSN(Online) : 2394-076X ISSN (Print):2394-0751
www.questjournals.org

Research Paper

Comparison of Accuracy of Dental Age Estimation Using London Atlas Method and Smith Method: A Radiographic Study

1. Dr. Veena K.M
Professor, Department of Oral Medicine and Radiology,
Yenepoya Dental College and hospital, Yenepoya university, Mangalore (575018), Karnataka
2. Dr Thufailath M
Postgraduate Student, Speciality of Oral Medicine and Radiology,
Yenepoya Dental College, Yenepoya University, Mangalore (575018), Karnataka
3. Dr Prashanth Shenoy
Senior Professor, Department of Oral Medicine and Radiology,
Yenepoya Dental College and hospital, Yenepoya university, Mangalore (575018), Karnataka
4. Dr Laxmikanth Chatra
Senior professor, Department of Oral Medicine and Radiology,
Yenepoya Dental College and hospital, Yenepoya university, Mangalore (575018), Karnataka
5. Dr Rachana V Prabhu
Assistant professor, Department of Oral Medicine and Radiology,
Yenepoya Dental College and hospital, Yenepoya university, Mangalore (575018), Karnataka
6. Dr Prathima Shetty
Associate professor, Department of Oral Medicine and Radiology,
Yenepoya Dental College and hospital, Yenepoya university, Mangalore (575018), Karnataka

Corresponding Author: Dr Thufailath M
Postgraduate Student, Department of Oral Medicine and Radiology,
Yenepoya Dental College, Yenepoya University, Mangalore (575018), Karnataka

ABSTRACT:
Aim and objectives*: The age estimation of the individual is extremely important in the field of forensic science for various purposes. There are different methods of age estimation including skeletal and dental methods. The aim of this study is to compare the accuracy of dental age estimation using London Atlas Method and Smith Method using panoramic radiographs*
Materials and Methods*: 32 Panoramic radiographs were collected and the dental age was estimated and compared between the two methods and also with the chronological age.*
Results*: Pearson's correlation is used to check the correlation between the chronological age and estimated age. Here we observe that there is significant correlation between the two with $p<0.001$ for both the methods*
Paired t test is used to compare chronological age and estimated age. Here we observe that there is no significant difference between chronological age and estimated age using London atlas method with $p>0.05$.
Conclusion*: our study results shows that there was no statistically significant difference between chronological and estimated age using the London Atlas Method. So, we conclude that this method can used for legal purposes.*
Keywords: *Age estimation, chronological age, London Atlas Method, Smith Method*

R*eceived 06 May, 2022;* ***R****evised 18 May, 2022;* ***A****ccepted 20 May, 2022 © The author(s) 2022.*
P*ublished with open access at* ***www.questjournals.org***

I. INTRODUCTION

During the growth process, our physiologic systems such as skeletal system and the dentition pass through a series of changes before arriving at maturity[1]. Teeth undergo various development stages in the first 25 years of a human's life. Formation of deciduous teeth begins in utero at about 4 months and permanent teeth complete formation at approximately 25 years of age. The sequence of the teeth development and maturation is uniform in all the individuals, i.e.; from the initiation of the formation of crown to the completion of apex closure will happen as a sequence. This sequence of teeth development is less affected by the environmental and socio- economic factors than the skeletal development (tooth formation is have low correlation with individual's weight, fatness and stature like skeletal development). The dentition is least affected tissue for these factors.[1] So, the teeth can be used as an aid in age estimation over the skeletal age estimation methods.

The various methods that have been proposed for age estimation in the field of forensics has to be used in different population to check the reliability and accuracy.

The atlas method of dental age estimation is easy to use and faster method for age determination. In the year 2010 AlQahatani et al developed London Atlas Method, which is one of the widely accepted atlas of dental development and alveolar eruption for age estimation in children and adolescents. The London Atlas is a pictorial book that requires the investigator to assess the stage of formation and eruption for each tooth, and then match it to one of the 31 illustrations of age categories representing both tooth formation and tooth eruption. The tooth formation stages were adapted from Moorrees et al. research and the eruption stages determined by research by Bengston.[2]

Smith's method is actually the modified version of a method originally introduced by Moorrees et al. which estimates the chronological age based on 14 developmental stages of eight mandibular teeth on the left side. As the Moorrees method couldn't explain about the completion of apex closure, Smith in 1991 modified the Moorrees method and added the time for apex closure to the Moorrees method of dental age estimation.[3]

The above-mentioned methods of age estimation have provided an accurate range of age in different populations. Currently, there is limited number of studies done in Indian population which estimates the age using London Atlas method with Smith's method.

Therefore, the aim of this study was to compare the accuracy of dental age estimation using London Atlas Method and Smith Method using panoramic radiographs and to compare it with the chronological age.

II. MATERIALS AND METHODS

After obtaining the approval form institutional scientific review board and issuance of ethical clearance from the university ethical committee, the study was conducted in the Department of Oral Medicine and Radiology. Panoramic radiographs were collected from the department database (Archives) that have been taken for various purposes. A sample group of 32 was selected with a simple random sampling technique.

Radiograph of patients with developmental anomalies or congenital anomalies, with diseases affecting the bone and teeth and radiographs with artifacts are excluded from the study and also radiographs with missing teeth on the left side of both maxilla and mandible is excluded from the study.

After selecting the OPGs from the archives, patient's identification number, gender, date of birth and date of exposure was noted down and the age is estimated using both London Atlas Method and Smith Method.

Dental age calculated using London Atlas Method-

The selected digital panoramic radiographs (orthopantomograms [OPGs]) was used to assess the status of the development and the eruption stage of the permanent teeth in maxillary and mandibular left side, from central incisor to the third molar. Then the age of the individual is estimated using the London Atlas of Human Tooth Development and Eruption by AlQahtani.

Dental age calculated using Smith Method-

Smith method of dental age estimation was done by directly comparing with the tooth developmental stages on panoramic radiographs with the standards using modified Moorrees et al stages and correnspondence age was noted. Then the mean age was calculated

Statistical Analysis

Pearson corelation coefficient was used to check the corelation between the age estimated using London Atlas Method and Smith Method and comparison was done using independent t-test. Statistical analysis was performed with Statistical Package for the Social Sciences software (SPSS, version 10.5) package. The significance threshold was set at 5%.

III. RESULTS AND OBSERVATIONS

Table 1 **Paired Samples Correlations**

		N	Correlation	Sig.
Pair 1	CHRONOLOGICAL AGE & LONDEN ATLAS METHOD	32	.764	<0.001
Pair 2	CHRONOLOGICAL AGE & SMITH METHOD	32	.762	<0.001
Pair 3	LONDEN ATLAS METHOD & SMITH METHOD	32	.958	<0.001

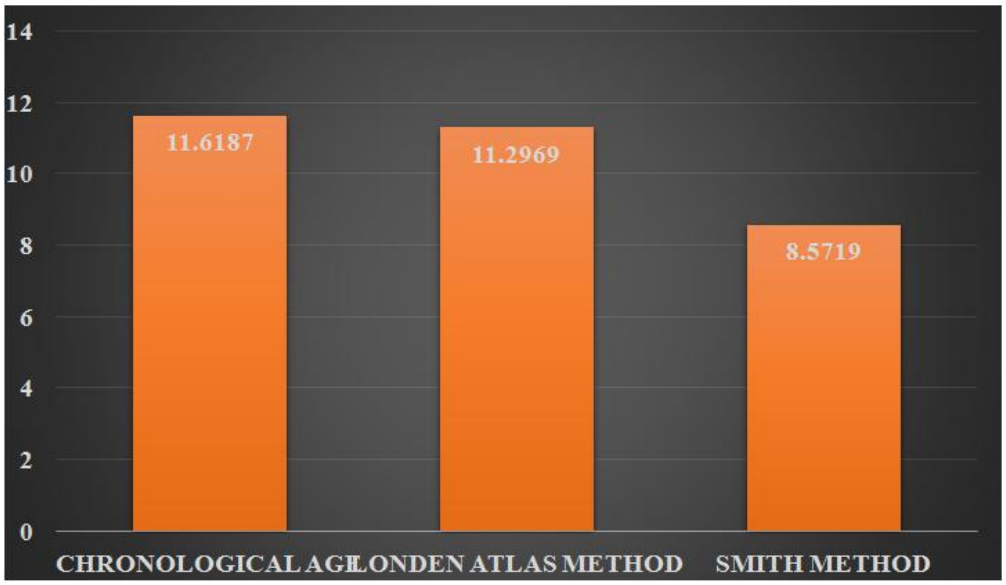
Pearson's correlation is used to check the correlation between the chronological age and estimated age.
Here we observe that there is significant correlation between the two with p<0.001 for both the methods.

TABLE 2 Paired Samples Statistics

		Mean	N	Std. Deviation	p-value
Pair 1	CHRONOLOGICAL AGE	11.6187	32	3.77824	0.471
	LONDON ATLAS METHOD	11.2969	32	3.41689	
Pair 2	CHRONOLOGICAL AGE	11.6187	32	3.77824	<0.001
	SMITH METHOD	8.5719	32	2.02297	
Pair 3	LONDON ATLAS METHOD	11.2969	32	3.41689	<0.001
	SMITH METHOD	8.5719	32	2.02297	

Table 2: Comparison of age using London Atlas Method and Smith Method to the Chronological Age

GRAPH 1: Comparison of age using London Atlas Method and Smith Method to the Chronological Age



Paired t test is used to compare chronological age and estimated age.
Here we observe that there is no significant difference between chronological age and estimated age using London atlas method with p>0.05.
And significant difference is observed between chronological age and estimated age using Smith's method.
Hence, we can conclude that London atlas method can be used to estimate age

IV. DISCUSSION

The mean chronological age of the sample group was 11.6±3.7 years. The mean estimated age using London Atlas Method was 11.2±3. years and using Smith Method was 8.2±2.0 years. Pearson correlation coefficient is used to check the correlation between chronological age and estimated age. We observed a significant correlation between the two methods with p value <0.001.

The estimated age using the London Atlas Method tends to underestimate the age by an average of 4 months and by Smith method underestimated the age by an average of 3 years.

Sharzad J et al[4] conducted a study comparing the accuracy of four age estimation methods, Willem's, Demirjian's, Cameriere's, and Smith Method using panoramic radiographs. The Smith Method showed a slight overestimation of the ages. In our present study, the Smith Method tended to markedly underestimate age. And reported that Smith Method had highest accuracy among all the four methods. However, this finding is also in contrary with the findings of the present study.

Alqahtani et al[5] used samples of known-age individuals (prenatal to 23 years) to compare the London Atlas with Schour and Massler's and Ubelaker's age estimation charts. While all three methods underestimated age, the London Atlas had the highest accuracy. For ages 3– 16 years (i.e., ages close to the age range studied in the present research), the London Atlas slightly overestimated age, but the ages estimated by the two other methods were still lower than the chronological age. In the present study the London Atlas Method slightly underestimated the age.

Alshihri et al[6] utilized the London Atlas for dental age assessment in Western Saudi children and adolescents. They found the atlas to slightly overestimate age. It is in contrary with the finding of the present study. The possible reason could be the ethnic difference of the study population which influence the tooth development and maturation.

A study conducted by Strahinja Pavlović et al[7] and David McCloe et al[8] using the London Atlas Method also showed a slight overestimation of age. This is again in contrary with the present study. The possible reason could be the eth nic difference of the study population which influence the tooth development and maturation. And also, the age of the study group also plays a role in determining the accuracy of the method used for age estimation.

Comparisons between the participant's chronological age and the ages estimated using London Atlas showed a very slight underestimation in all the study subjects (4 months). On contrary Smith method tended to underestimate the age in whole study sample (3 years). The differences between the chronological and estimated ages were significant in Smith Method and there were strong linear correlations between the chronological age and ages estimated by both the London Atlas and Smith's method. Similar observation was seen in study conducted by Ghafari et al[3], which showed a strong linear correlation between the chronological age and ages estimated using London Atlas and Smith Method.

In this present study we observed that there is no significant difference between chronological age and estimated age using London atlas method with p>0.05 and a significant difference is observed between chronological age and estimated age using Smith's method.

The results from that study clearly show that the estimation using the London atlas is closer to the chronological age.

V. CONCLUSION

The importance of forensic age estimation is becoming one of the pillars of forensic science. The use of various techniques has an application in different aspects. The results obtained from this study show that the London atlas of tooth development can be used as a method to estimate the age of an individual. Since our results strongly showed that there was no statistically significant difference between chronological and estimated age. we can conclude that this method has a potential to be used for legal purposes.

REFERENCES

[1]. Verma M, Verma N, Sharma R, Sharma A. Dental age estimation methods in adult dentitions: An overview. Journal of forensic dental sciences. 2019 May;11(2):57.

[2]. AlQahtani SJ, Hector MP, Liversidge HM. Brief communication: the London atlas of human tooth development and eruption. American Journal of physical anthropology. 2010 Jul;142(3):481-90.

[3]. Ghafari R, Ghodousi A, Poordavar E. Comparison of the accuracy of the London atlas and Smith method in dental age estimation in 5–15.99-year-old Iranians using the panoramic view. International journal of legal medicine. 2019 Jan 14;133(1):189-95.

[4]. Javadinejad S, Sekhavati H, Ghafari R. A comparison of the accuracy of four age estimation methods based on panoramic radiography of developing teeth. Journal of dental research, dental clinics, dental prospects. 2015;9(2):72.

[5]. Dhamo B, Kragt L, Grgic O, Vucic S, Medina- Gomez C, Rivadeneira F, Jaddoe VW, Wolvius EB, Ongkosuwito EM. Ancestry and dental development: a geographic and genetic perspective. American journal of physical anthropology. 2018 Feb;165(2):299-308.

[6]. Alshihri AM, Kruger E, Tennant M. Dental age assessment of Western Saudi children and adolescents. The Saudi dental journal. 2015 Jul 1;27(3):131-6.

[7]. Pavlović S, Pereira CP, de Sousa Santos RF. Age estimation in Portuguese population: The application of the London atlas of tooth development and eruption. Forensic science international. 2017 Mar 1;272:97-103.
[8]. McCloe D, Marion I, da Fonseca MA, Colvard M, AlQahtani S. Age estimation of Hispanic children using the London Atlas. Forensic science international. 2018 Jul 1;288:332-e1.