

## G16 Dental Age Estimation: A Comparison of Three Methods of Estimating Dental Age in a Population of Kuwaiti Children, Adolescents, and Young Adults

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**Learning Overview:** The goal of this presentation is to evaluate the mean age difference between Chronological Age and Dental Age (CA-DA) using the Simple Average Method (SAM), the London Atlas method, and Moorrees data of tooth development stages, in addition to measuring agreement between the proposed three methods.

**Impact on the Forensic Science Community:** This presentation will impact the forensic science community by providing evidence of the DA assessment method accuracy in comparison to CA. This may influence the decision of which dental age assessment is to be used in certain situations. Decision-making is based on the accuracy of the method, its applicability, and how quickly it can be applied.

**Background:** There has been an increase in the demand for age assessment in the living due to illegal migration.<sup>1</sup> Dental Age Estimation (DAE) is a surrogate for CA as it is the most accurate of the biological markers used to estimate the age of individuals.<sup>2</sup>

The DA of Kuwaiti children and adolescents was estimated using the SAM utilizing all teeth present in the maxilla and mandible on the left side, the Atlas Method to assign an “age” to a subject utilizing the Atlas schemes, and the Moorrees method assessing the ten teeth described in the original paper and with the numerical data derived by “reverse engineering.”<sup>3-5</sup> The DA estimated by these three methods was compared to the CA.

**Patients, Materials, and Methods:** The sample was Dental Panoramic Tomograms (DPTs) from the archives of Kuwait Ministry of Health Dental Hospitals comprising 402 healthy children aged between 5 and 15 years. Exclusion criteria were unsatisfactory images, presence of dental anomalies such as tooth agenesis or supernumerary teeth, and a medical condition that may be deemed to influence dental development. In addition, non-Kuwaiti nationality subjects were excluded from the study.

Each of the anonymized DPT was assessed in random order and personal details masked from the observer.

SAM and the Moorrees methods assessed dental age utilizing Draft Dental Age Quicksheets.<sup>6</sup> The London Atlas method matches DPT radiographs as closely as possible to one of the 23 schematic drawings.

**Ethical Approval:** This was granted by The Standing Committee for Co-ordination of Medical Research at the Ministry of Health, the State of Kuwait—Certificate #899/2018.

**Reference Data Set 2:** This consisted of 1,393 Kuwaiti children, adolescents, and young adults comprising 801 females aged from 2.80 years to 25.8 years and 586 males aged 3.23 years to 25.77 years.

**Results:** Intra- and inter-examiner agreement were calculated using Cohen's Kappa with scores of 0.76 or above which is “good to excellent” agreement.

The CA minus DA difference is an overestimate of 0.39 years for females and an underestimate of 0.14 years for males. The London Atlas overestimated the CA by 0.60 years for females and 0.19 years for males. Moorrees technique gave an underestimate of 1.01 years for females and 0.89 years for males. Bland-Altman plots showed an even distribution of difference around the CA.<sup>7</sup>

**Conclusions:** The SAM technique is the most accurate with a two-to-three-month CA Minus DA difference. The Atlas method was less accurate. The Draft Quick Sheets makes the implementation of SAM a rapid procedure. This makes the SAM the favored technique for DAE in a forensic science setting where ethnic-specific reference data are important.

### Reference(s):

1. Law H., Mensah L., Bailey S., Nelki J. Immigration, Asylum Seekers and Undocumented Identity. In: Black S., Aggrawal A., and Payne-James J. *Age Estimation in the Living*. Wiley-Blackwell. Chichester. 2010. pp 19–29.
2. Demirjian A., Buschang P.H., Tanguay R., Kingnorth Patterson D. Interrelationships among measures of somatic, skeletal, and sexual maturity. *Am J of Orthodont*. 1985; 88(5): 433-438.
3. Roberts G., McDonald F., Lucas V.S. Age estimation in the Living: Dental Age Estimation—Theory and Practice. In Payne-James J. and Byard R.W. (eds). *Encyclopedia of Forensic and Legal Medicine*, 2nd Edition. 2016. Vol 1. pp 46-69.
4. Al Qahtani S.J., Hector M.P., Liversidge H.M. Accuracy of dental age estimation charts: Schour and Massler, Ubelaker, and the London Atlas. *Amer. J. Phys Anthropol*. 2014; 154(1): 70-78.
5. Moorrees C.F., Fanning L.A., Hunt L.E. Age variation of formation stages for ten permanent teeth. *Journal of Dental Research*. 1963; 42(6): 1490-1502.
6. Draft D., Lucas V.S., McDonald F., Andiappan M., Roberts G. Expressing uncertainty in Dental Age Estimation: A comparison between two methods of calculating the “average standard deviation.” *Journal of Forensic Sciences* 2019; April: 1-4 doi 10.1111/1556-4029.14049.
7. Roberts G., McDonald F., Lucas V.S. Dental Age Estimation: Theory and Practice. *Encyclopedia of Forensic and Legal Medicine*, 2nd Edition. 2015. doi:10.1016/B978-0-12-800034-2.00007-0.

### Dental Age Estimation, Dental Age Assessment, Kuwaiti Reference Data Set

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