



G2 Dental Maturation and Age Estimation in Children With Down Syndrome

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After attending this presentation, attendees will be aware of the importance of estimating the correct age in Down syndromic individuals for ethical and legal reasons.

This presentation will impact the forensic science community by focusing on the difficulties in the evaluation of dental maturation of individuals with Down syndrome due to the frequent agenesis that affects these subjects.

Background: Estimating dental age based on tooth stage and maturation is relevant for the forensic identification of decedents and living subjects. Tooth data are crucial in the reconstruction of the biological profile in criminal and administrative cases, unlawful immigration, asylum seekers, and international adoption cases. Very few scientific papers study the possible influences of genetic, chromosomal, or metabolic diseases on dental development.

Down syndrome is one of the most common chromosomal syndromes, which can lead to severe growth and developmental abnormalities. Recent birth statistics in the United States document an increasing prevalence of Down syndrome, currently occurring in 11.8 per 10,000 births. Children with Down syndrome are five times more likely to manifest hypodontia, but very few studies have examined the outcome of this pathological condition on tooth development and the age estimation assessment.

The dental eruption timing in Down syndrome children is supposedly different than that of non-syndromic individuals; many authors state that the eruption of primary and permanent teeth is delayed, that the primary teeth are not always completely formed before the age of five, and that tooth eruption in females is later than in males. Previous studies also reported different conclusions, therefore, further research in this field is needed.

Goal: The present study seeks to evaluate the possible effects of Down syndrome on dental development and the estimation of dental age compared to individuals unaffected by this genetic disorder.

Methods: A representative sample set of 136 Orthopantomographs (OPGs) were taken of Down syndrome subjects who underwent radiological examination for medical reasons from 2001 to 2014 at Meyer Hospital of Florence (Italy). The records were then subjected to the following exclusion criteria and individuals matching these criteria were excluded: older than 22 years of age or younger than 7 years of age; an unclear radiogram; symmetrical agenesis; or a clinical history of dental extractions. Fifteen records were eliminated from further analysis. A total of 121 OPGs of Down syndromic patients were analyzed, including 49 males and 72 females, whose ages ranged from 7 years to 22 years. The chronological age of each individual has been calculated in days according to the date of the X-ray examination. The mean and median differences between dental age and real age were calculated. One hundred fifty children (75 male, 75 female) without clinical evidence of developmental abnormalities or a history of familial disease was considered as the control group.

All individuals of the experimental sample were divided into four age groups: 7 years-10 years, 11 years-14 years, 15 years-18 years, and 19 years-22 years. Dental maturation of all components of each group were evaluated with two different methods: Demirjian and London Atlas.

After training and calibration, all radiographs were assessed by two experienced operators; the date of birth of each subject was not known to the operators in order to avoid any bias during the estimation procedure.

All the lower left jaw teeth were considered for analysis. In case of absence of teeth from the lower left jaw due to agenesis, the corresponding lower right tooth was considered for the examination according to the Demirjian's study. The analysis of the wisdom teeth in the lower left jaw was considered only in one case: the lower right third molar was analyzed because of left-right symmetrical third molar development as reported in the literature.

The analysis of the dentition up to the second molar and up to 16 years of age was performed with the following methods: Demirjian's original seven-tooth method was used when the seven lower teeth were present (on the left or right side); and the London Atlas was used in all other cases. The London Atlas, developed by Queen Mary University of London, facilitates the age estimation using tooth development and alveolar eruption of individuals from 28 weeks *in utero* up to 22 years of age. The Gleiser and Hunt method was used to estimate the development of the wisdom teeth for subjects up to 15 years of age.

The accuracy and reproducibility of the applied methods involved the re-examination of 12 radiographs (10%), which were randomly selected from the sample set and reassessed by two operators two months after the initial assessment. Therefore, to evaluate the intra- and inter-rater agreement, statistical tests were applied. Regular permission to perform this study was previously obtained from the Regional Ethical Committee.

Conclusion: Preliminary results from this study reveal that there are many cases of dental agenesis in individuals with Down syndrome, which presents challenges when using age estimation methods based on a predetermined tooth pattern. The study suggests the London Atlas, which facilitates the age estimations by using even a single tooth, is the most suitable for subjects with Down syndrome who are affected by multiple agenesis.

Although the poor data reported in the literature regarding dental development in Down syndromic patients and the delay in dental eruption stated this is a common feature in these patients, despite the clinical evidence, this has never precisely been quantified using identification tables relating

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to the methods most commonly used.

The subjects included in the experimental group were only delayed 51.35% compared to non-syndromic people, with a higher female percentage. The result of this present study shows that the speed of dental maturation is influenced by the gender, and also demonstrates a higher percentage of variability of speed of dental maturation within the range of 11 years to 14 years of age.

Forensic odontologists could experience difficulty assessing the age of these subjects using common methods and overestimate the chronological age of these special patients.

Down Syndrome, Forensic Odontology, Tooth Development