

# Proposed Recommendation of Dental Age Estimation in Indian Population

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## Abstract

The historical development of age estimation and the different techniques are presented. Also it is important to separate individuals below 18 years where tooth development can be used and those above 20 years of age where regressive changes must be used and where the visual assessment may be more important. Suggestions for new recommendations are presented. Finally the Indian dental age estimation project of BR in Northan Indian who claim to be below 18 years of age is described.

**Keywords:** Age estimation; Quality assurance, Project

## Introduction

Dental age estimation can be divided into two periods in life. The first period is when the teeth are developing in the jaws up to 20 years. Comparison of the developmental stages with tables for the different stages may here be used as a scientific statistical method. Later, when all teeth are fully formed regressive age related changes might be used as a scientific method. Such methods are less accurate than methods based on the developmental stages. Dental age estimation may be performed both in living and dead persons. The same methods may be applicable. However for dead persons it is rarely possible to get any information about the living conditions and diseases of the individual. In addition, the teeth may be extracted and ground according to the different techniques for more accurate studies. An examination of the mouth and the dental conditions is an integrated part of age estimation in both living and dead persons. Such an examination should end with a visual assessment of the age of the individual. In many identification cases where we have good dental records the age estimation is of less importance. Thus a visual assessment may be enough. However, in cases where the age estimation may be greater importance, at least two scientific methods should be used.

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## Age estimation of individuals below 20 years of age

Most scientific studies have been aimed at the construction of developmental tables for the different stages of tooth formation and how fine these stages can be graded without being imprecise and difficult to determine. Generally, only studies made after 1960 have sufficiently large material and fine grading so they should be used to calculate the age of the individual. These methods, based upon the developmental stages, are more accurate than age estimation based on the stages of eruption of teeth. Therefore, visual age assessment methods have not often been performed in these age periods and the trust in the statistical scientific tables has been strong. However, the dental development may be retarded by severe and long lasting diseases. This may also be the case in many congenital syndromes. Only rare hormonal hyper secretion may accelerate the development. Also nutritional deficiencies may retard the dental development. Severe dental diseases and tooth extraction may also influence the dental development. For a most accurate assessment of the age it is necessary to assess these factors and take them into consideration. In India we are using at one age estimation techniques in cases of age estimation in individuals below 20 years of age. Generally we are using the tables from Balwant rai in Northan Indian population 1 .

## **Age estimation of individuals above 20 years of age**

In dental age estimation of individuals above 20 years scientific methods must rely upon regressive age changes such as attrition, loss of periodontal attachment and secondary dentin formation. Such parameters are partly influenced by function and also by pathologic processes and are thus far less accurate compared to the developmental stages of the teeth. Thus, in these cases the visual assessment may be almost as accurate as the calculated age according to a specific technique. A visual assessment may thus be an important supplement to scientific methods. The first scientific technique for age calculation in adults was presented by Gustafson<sup>2</sup>. It was based on longitudinal sections of teeth cut through the central area. It can not be used for living person, only in dead when extraction of a tooth is allowed. The technique consisted in attributing scores from 0 to 3 for the presence and amount of age related changes such as attrition, periodontal ligament retraction, secondary dentin formation, root translucency and root resorption. The scores were added and a regression analysis with age as dependent variable was performed. Later his method has been modified by several researchers<sup>2-6</sup>. All these formulae are based upon regression analysis e.g. multiple regression with age as dependent variable and the different age related changes as independent variables. The formulae are generally most accurate around 40-50 years and with increasing inaccuracy in younger and especially in older age groups. Also another difficulty is that there is a pronounced tendency for overestimation of younger persons and underestimation of older persons. These facts must be taken into consideration when making the final conclusion.

In living persons, it is not possible to extract teeth and grind them according to the different techniques. Thus a radiologic technique like the one developed by Jasdeep kaur and Balwant rai is one of the few that can be used. It is based only on the size of the pulp in relation to the whole tooth and gives a measure of the secondary dentin formation. However it is partly dependent on the anatomy of the tooth and

pulp. Formulae exist for each of different teeth<sup>7</sup>.

An alternative morphologic technique in living persons is the morphologic technique by Balwant rai<sup>4</sup>. This technique is based only upon attrition, and recession of the periodontal attachment, all variables that can be assessed in a living individual. For most methods of age calculation there is only one regression formula that is used for all types of teeth. This is obviously inaccurate as teeth emerge in the oral cavity at different times. Also the contribution of different types of teeth in chewing vary and thus the expected changes. We therefore hold that the best method should have one formula for each type of tooth.

It is difficult to collect extracted teeth to be used as material for methods of age calculations. Therefore, for some methods more than one tooth from the same individual has been used. For others the material is not described accurately enough so that the use of only one tooth from each individual can be verified. It may be obvious that the variation within one individual is less than between different individual. Thus this may result in a too small standard deviation and it may look like the method is more accurate than it really is.

### **New recommendation for quality assurance in age estimation**

In the following the recommendations are proposed by Jasdeep Kaur and Balwant rai .

The purpose of the age examination is to:

1. Estimate the most likely age of the individual;
2. Make reference to the methods used.

All agreed on these steps. These are the more mechanical looking up a stage in a table or apply a formula. There is no assessment by the expert in this and the age estimation could in fact be done by anyone. There is no requirement of stating a standard deviation or confidence interval. It would always be incorrect as it is only valid for the individuals the method is based upon. We should never give any wrong figures in our reports and especially when it comes to statistics. However, the figures for the distribution of the data must only be taken as

indicative for the real variation in the actual population.

As optional steps were that the purpose also is to:

3. Express the likelihood of an official age, if it exists;

4. Express the likelihood of an alternative age if it exists.

If the commission is given by the police they will ask explicitly for what they want to know. However others like private persons or schools, etc. do not know what to ask for. In my mind it is self evident that we have to take the official age and the alternative age into consideration, instead of just saying something about the standard deviation. We should express the likelihood of these two ages and if one can be excluded. If we do not do this, it is left to lawyers to argue without proper statistical understanding. The question is, however, whether forensic odontologists have sufficient understanding of statistics.

Optional is also the way of arriving at the final estimate by using:

1. The expert's own assessment;
2. Information from the person on the living conditions and diseases;
3. The results from scientific statistical methods.

As some dentists are not interested in background information the collection of these are also optional. They should be: family economy, food supply, water supply, serious diseases, previous dental problems and treatment, dental hygiene.

There was only agreement on checking the identity of the examined person during the clinical examination. Evaluating the oral mucosa and describing the dentition as far as occlusion, teeth present in the mouth, individual characteristics of the teeth, degree of attrition, colour of the teeth, staining and calculus, periodontal conditions and visual age assessment, solely based upon the teeth, are optional.

It was agreed to carry out a radiographic examination which should include radiographs

that may enable the age estimation methods decided upon and which should describe the dentition and individual characteristics of the teeth. It was also agreed to use as many appropriate parameters as possible, to use methods as originally described in the literature and to use as many teeth as possible. Using at least two independent statistical methods was left as an option. Finally the conclusion should end with a complete assessment of the most likely chronological age.

As some of the participants would not make a clinical assessment nor ask for background factors, they had naturally difficulty with taking these factors into consideration in the final assessment of the age.

The optional factors were:

1. Assess if the methods are appropriate in relation to the individual;
2. Assess factors which may have influenced the tooth development or ageing;
3. Assess especially if pathologic factors or other may have influenced the findings.

#### **Final remarks**

We believe that this is the way to go for international guidelines on quality assurance in forensic odontology and in age estimation in particular. Steps to be observed should be specified on an international level and the exact technique to be used at each step should be left to the national societies. We have shown that this type of quality assurance is practicable in our age estimation . We have also suggested a improvements in the recommendations with due consideration to those who do not want to make any expert assessment, but confine themselves to reporting the result from a table or a formula.

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