Age estimation of unaccompanied minors
Part II. Dental aspects

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Abstract

Recent years have brought a worldwide increase in cross-border migration due to a globalized economy and ongoing belligerent conflicts. As a result, the percentage of foreigners among the general population has steadily increased not only in Germany, but also in other countries. This trend has triggered a growing demand for forensic medicine to assess the age of adolescents and young adults. The individuals examined here are unaccompanied minors without valid identification documents who do not know their age or else are suspected of not giving their correct age.

The mineralization of third molars is the main criterion for dental age estimation of living subjects in the relevant age group. To date insufficient knowledge has been obtained about how ethnic origin can influence tooth mineralization. This, however, constitutes a restraint on the reliability of age estimates and hence on the forensic value of information essential to legal security. A comparative study was conducted to present comparative data on third molar mineralization in a Caucasoid, Mongoloid and African sample. In conclusion, forensic age estimates of living subjects would be more powerful tools if population-specific standards were applied to evaluations of wisdom tooth mineralization.

Since the mineralization of third molars is usually completed by the age of 19 or 20 years, this feature cannot be used to ascertain whether a person has attained the forensically relevant age of 21 years. The question was whether determination based on an orthopantomogram of a combination of features relevant to dental age estimation of adults supplies forensically useful information for ascertaining whether a person has attained 21 years of age. An additional X-ray examination of the medial clavicular epiphyseal cartilage is, therefore, strongly recommended when assessing whether a person is over 21.

1. Wisdom tooth mineralization—ethnic differences

One question of major practical relevance to estimating age from a dental view is whether the reference data customarily used for forensic diagnosis, derived from white North Americans on the one hand and Central and Northern Europeans on the other, can also be applied to members of other ethnic groups.

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Few comparative studies are available on the subject of wisdom tooth mineralization.

Gorgani et al. [1] examined 229 black and 221 white US citizens aged 6–14 years. Among the black subjects crown mineralization of the third molars was completed 1 year earlier.

Harris & McKee [2] studied 655 white and 335 black US citizens aged 3.5–13 years. Whereas the black subjects reached the earlier stages of wisdom tooth mineralization about 1 year earlier, the gap appeared to narrow for later stages.

This trend is confirmed by the work of Mincer et al. [3]. They examined 823 US citizens (80% white, 19% black) aged 14–25 years but did not establish any significant differences in the time frame for wisdom tooth mineralization.

Keywords: Dentition; Ethnicity; Third molar mineralization; Forensic age estimation
Daito et al. [4] addressed wisdom tooth mineralization in 911 Japanese youngsters aged 7–16 years and compared their data with the values provided by Gravely [5], Rantanen [6] and Haavikko [7] for Caucasoid populations. No significant differences were discovered.

These studies only lend themselves to limited comparison due to small sample sizes, varying methods and assessment by different observers. A further problem lies in the fact that the age data for subjects of black African origin often were not verified. Moreover, most available studies focus on the earlier stages of mineralization.

Stages of formation have been defined differently in past publications by Gleiser & Hunt [8], Moorrees et al. [9], Kullman et al. [10] and Köhler et al. [11]. The stages described in these classifications are sometimes numerous and difficult to match against each other. Moreover, a distinction is drawn between, for example, 1/4, 1/3, 1/2 and 2/3 of the estimated future length of root, resulting in a rather subjective approach to estimation.

Demirjian et al. [12] presented a breakdown based on four distinct stages each for the crown and the root (stages A–H). The authors avoided numbering the stages in order not to create the impression that they are all of the same duration. Demirjian’s stages are defined by changes in shape and do not depend on speculative estimates of length. For this reason, we chose Demirjian’s classification as the most suitable one for our investigation.

A comparative study of wisdom tooth mineralization [13] was carried out on three population samples: one German, one Japanese and one South African. To this end, 3652 conventional orthopantomograms were evaluated on the basis of Demirjian’s stages.

Statistically significant differences between the samples investigated were established for the age at which stages D–G of third molar mineralization were achieved.

Significant differences between German and Japanese males were noted for stages D–G of mineralization. Significant differences between Japanese and German females were observed for stages D–F. According to our findings, Japanese males and females were approximately 1–2 years older than their German counterparts when they reached stages D–F.

Significant age differences between South African and German males applied to stages D–E. Significant age differences between South African and German females were observed for stages E and G. The South African subjects were approximately 1–2 years younger than the German subjects upon achieving these stages of mineralization.

Significant age differences between the South African and Japanese samples were ascertained for both genders at stages D–G. The South African subjects were approximately 1–4 years younger than the Japanese subjects upon reaching these stages.

In summary, Olze et al. [13] state that, if they consider the predominant stage of mineralization in any given age group, the Caucasoid sample we investigated occupied the middle position by age for each stage of mineralization investigated. For stages D–F, the Mongoloid subjects were on average 1–2 years older, whereas for stages D–G the African subjects were about 1–2 years younger than Caucasoid subjects who had obtained the same level of mineralization.

The population differences observed here may be due to differences in palatal dimensions between the ethnic groups surveyed. The largest palatal dimensions are observed in Africans and the smallest in Mongoloids, with Caucasoids assuming the middle rank [14]. Inadequate space in the maxillary crest causes delay in wisdom tooth eruption, if not retention [15]. In turn, retained wisdom teeth mineralize later than teeth whose eruption has not been impeded [11]. This would explain why Caucasoid populations occupy the middle position in relative terms when it comes to wisdom tooth mineralization, while Mongoloid populations occupy the middle position in relative terms when it comes to wisdom tooth mineralization, while Mongoloid populations occupy the middle position in relative terms when it comes to wisdom tooth mineralization, while Mongoloid populations occupy the middle position in relative terms when it comes to wisdom tooth mineralization, while Mongoloid populations occupy the middle position in relative terms when it comes to wisdom tooth mineralization, while Mongoloid populations occupy the middle position in relative terms when it comes to wisdom tooth mineralization, while Mongoloid populations occupy the middle position in relative terms when it comes to wisdom tooth mineralization, while Mongoloid populations occupy the middle position in relative terms when it comes to wisdom tooth mineralization, while Mongoloid populations occupy the middle position in relative terms when it comes to wisdom tooth mineralization, while Mongoloid populations occupy the middle position in relative terms when it comes to wisdom tooth mineralization, while Mongoloid populations occupy the middle position in relative terms when it comes to wisdom tooth mineralization, while Mongoloid populations occupy the middle position in relative terms when it comes to wisdom tooth mineralization, while Mongoloid populations occupy the middle position in relative terms when it comes to wisdom tooth mineralization, while Mongoloid populations occupy the middle position in relative terms when it comes to wisdom tooth mineralization, while Mongoloid populations occupy the middle position in relative terms when it comes to wisdom tooth mineralization, while Mongoloid populations occupy the middle position in relative terms when it comes to wisdom tooth mineralization, while Mongoloid populations occupy the middle position in relative terms when it comes to wisdom tooth mineralization, while Mongoloid populations occupy the middle position in relative terms when it comes to wisdom tooth mineralization, while Mongoloid populations occupy the middle position in relative terms when it comes to wisdom tooth mineralization, while Mongoloid populations occupy the middle position in relative terms when it comes to wisdom tooth mineralization, while Mongoloid populations occupy the middle position in relative terms when it comes to wisdom tooth mineralization, while Mongoloid populations occupy the middle position in relative terms when it comes to wisdom tooth mineralization, while Mongoloid populations occup...
disposing influences such as composition of saliva and resistance of dental matter promote or inhibit the likelihood of pathological changes.

Eating habits in western industrialized countries have changed in the last 150 years. Increasing sugar consumption has correlated with a considerable increase in the prevalence of caries.

In addition, constant and regular ingestion of acidic food is problematic with regard to dental health. Today we observe a preference for acidic or sour food and beverages among teenagers and young adults [20]. This applies in particular to the enormous increase in the consumption of soft drinks which contain various fruit acids as flavour enhancers, ascorbic acid as an antioxidant, benzoic acid as a food preservative and carbonic acid for a sparkling effect.

Moreover, dental health also strongly depends on people’s behaviour after consuming acidic beverages. If, shortly after contact with acidic food, teeth are exposed to mechanical oral hygiene procedures, such as heavy tooth brushing, or heavy chewing of abrasive food or chewing gum, those areas of the teeth superficially dissolved by the acids are at risk of erosion.

Drawing on the results of their study, Olze et al. [19] can summarize by observing that a determination, based on orthopantomograms, of variations on the DMFT index appears to provide a unsuitable additional criterion for forensic age estimation of young adults. By contrast, the evaluation of single variables does not yield sufficient data to determine with the accuracy required in criminal proceedings whether a person has attained 21 years of age.

An additional X-ray examination of the medial clavicular epiphyseal cartilage is, therefore, strongly recommended when assessing whether a person is over 21.

References