

Summary of: Estimating age and the likelihood of having attained 18 years of age using mandibular third molars

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FULL PAPER DETAILS

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Objective Age estimation methods using mandibular third molar (M3) root formation were tested. Diagnostic accuracy of M3 to predict age 18 was tested. **Design** Methods were tested on a target sample of 300 dental panoramic radiographs (age 11–25). Diagnostic accuracy was assessed on separate reference data (n = 1,663, age 9–25). Root stage was the diagnostic test predicting 18 years of age. **Methods** Root stage of M3 was assessed and age estimated (n = 157) using published methods that use Demirjian or Moorrees root stages. The difference between dental and known ages was assessed. Diagnostic tests and likelihood ratios were calculated for reference data. **Main outcome measure** Mean difference (bias), standard deviation and absolute mean difference between dental age and known ages. Likelihood ratio of age 18, given M3 root stage. **Results** Only six of 37 methods estimated age with bias not significant to zero. Mean absolute difference between dental and known age for these methods ranged from 1.45 to 1.97 years. Standard deviation of bias for all methods was around 2 years and 95% confidence interval of estimated age is ± 4 years. The best methods using Demirjian and Moorrees stages are detailed. Likelihood ratio of being at least 18 if M3 was mature was 13.61. If M3 was 'A1/2' (apex half closed) or mature, on the balance of probabilities, estimated age was at least 18. **Conclusion** Most methods using M3 root formation estimate age with significant bias. If M3 is mature, age 18 is more than likely attained.

EDITOR'S SUMMARY

One of the privileges of this job is to witness the immense breadth of subjects, topics and issues that are touched on, or influenced by, dentistry. Indeed one of the fascinating connections, in my view, is between the biological and clinical worlds of dentistry as a practised art and science and the social contexts within which it takes place.

This paper provides a definitive example of how the two spheres of activity overlap, inform each other and directly affect not only oral health but also the implications for general health and social welfare. As the study clearly discusses, the estimation of age through dental evidence finds application in the living as well as the deceased. Both are equally important in terms of accuracy for a variety of legal, social and moral reasons depending on the circumstance. Therefore, the veracity of the science behind the estimation is also of cru-

cial importance. There is a tendency to overlook the fact that we have not suddenly invented activity centred on evidence-base but that it has been the cornerstone of the legal process for centuries. In such a context the degree of reliability of 'evidence' under cross-examination is about as absolute as it can be, at least within the bounds of a given society's framework of acceptability. Consequently, a well conducted and robust study such as this is to be welcomed in order to add to the weight and substance of the scientific body of knowledge.

But, such is the complexity of context that the twist in the scientific tail is the question of whether the taking of radiographs (in the living) is morally justified in the establishment of age compared with the theoretical and actual risk from the radiation. But that, as they say, is a whole different story. Having the most accurate data available means that we

can judge such risks to the best of our ability. Fascinating stuff.

The full paper can be accessed from the *BDJ* website (www.bdj.co.uk), under 'Research' in the table of contents for Volume 209 issue 8.

Stephen Hancocks

Editor-in-Chief

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IN BRIEF

- Provides two easy methods to estimate age from mandibular third molar root formation stages.
- Provides an estimate of the probability of age being at least 18, applicable to a single individual, for each mandibular third molar root stage.
- Proposes an age interval for each mandibular third molar root stage to help interpret the legal term 'on the balance of probabilities'.

COMMENTARY

This paper *Estimating age and the likelihood of having attained 18 years of age using mandibular third molars* by Liversidge and Marsden combines the expertise of one of the UK's most important contributors to the field of chronology of human dental development with one of the nation's leading forensic odontologists. It extends a large body of previous work by Dr Liversidge and her graduate students such as the improved and currently relevant update to the almost ubiquitous Schour and Massler wall chart of dental development that was published so long ago. The current paper is very important. At a time when the world is experiencing huge and unprecedented movements of people, issues of border security arise. This in turn may require physical evidence to corroborate identity: a mainstay of forensic odontological practice, and this may involve the interpretation of radiological images to establish age. A common scenario is that a refugee or migrant may have been granted residency as an adult and then after being arrested for some later offence claims to be a child and therefore seeks to be tried in a court that is more lenient to minors. Similarly, in the aftermath of atrocities and when mass graves are opened and investigated a reverse situation may apply because the murder of children rather than adults is likely to attract more disapprobation and hence more severe punishments by tribunals. In these and other scenarios it is very important that experts called to give evidence are able to calibrate their

strength of opinion with real, rigorous scientific evidence such as is presented in this meticulously conducted and very comprehensive study. In some quarters this type of research, seen against rapid developments in oral immunology or molecular biology, is often dismissed as 'observational' and therefore carries the implied stigma of being old-fashioned, nineteenth century, and out-of-date. The results of this simple but rigorous study using well-established scoring methods combined with robust statistics and large samples provide hard evidence to refute such opinions. The authors should be recognised for conducting a study that is long overdue and which provides urgently needed data for the profession and the courts.

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AUTHOR QUESTIONS AND ANSWERS**1. Why did you undertake this research?**

There is an urgent need for an evidence-based comparison of dental ageing methods particularly of the third molar. The mandibular third molar is used to predict age in asylum seekers who claim to be under 18, forensic cases and disaster victim identification. We undertook this study to find out which method of age estimation based on mandibular third molar root formation is best, how this is usefully measured and what the confidence interval of estimated age is. We hope to stimulate discussion and further research in this field.

2. What would you like to do next in this area to follow on from this work?

We would like to see these two new methods tested on a large independent sample of radiographs. Future research might evaluate other methods of performance including a Bayesian approach. Other measures of maturity in young adults include bones of the wrist, cervical vertebrae and clavicle. There is a need for a large reference sample to document normal development, to understand interactions between all these systems, to quantify differences between groups and to compare accuracy in age prediction.