Malaysian J Pathol 1995; 17(1): 31 - 34

Age estimation using third molar development

PHRABHAKARAN Narnbiar, **BDS, MScD.**

Dean's Office, Faculty of Dentistry, University of Malaya, Kuala Lumpur.

Abstract

Teeth are the most durable structures in the human body. The pattern of their development has been used as a credible technique of age determination of unidentified bodies. Dental age estimation is by comparison of the dental status of an individual with published dental surveys. The third molars are the last teeth to erupt and are regarded as the most variable in the dentition. Nevertheless, radiographs depicting their growth have been used to determine the chronological age. A case for actual need for age estimation using a developing third molar is presented here.

Key words: Tooth formation, third molar, age determination.

INTRODUCTION

When one must identify a deceased individual, accurate determination of the age of the person is very important. Teeth, which provides the life history of an individual contribute as a reliable means of determining age from approximately 10 weeks intrauterine up to old age.' Determining dental age using stages of tooth development and eruption, structural changes on these teeth and the changes in the chemical composition of teeth have been successfully advocated by many researchers. In juveniles, dental age is estimated by comparing the dental developmental status of the child, whose age is unknown, with published dental developmental charts and tables.[2-6] By so doing, the likely chronological age for the individual can be successfully deduced. It has been further observed that the incremental pattern of tooth development or formation is not markedly affected by diseases, drug intake and dietary changes. Teeth, being the hardest calcified tissue in the body, tend to be intact even when other components of the skeleton have disintegrated. The high resistence of teeth to severe insults such as cold, heat, fire and chemicals make them the favourite tissue in forensic and archeological investigations. Some researchers prefer tooth formation to tooth eruption (i.e. actual emergence of the tooth in the oral cavity) for assessment of age. This is because eruption can be influenced by exogenous factors such as infection, injury at the area, obstruction, overcrowding, earlier extraction of deciduous teeth etc. whereas, formation is a continuous process until the tooth is completely calcified.

Structural changes on fully erupted teeth were reported by Gustafson? He was the first to provide a scientific age assessment from changes on the teeth. Six histological alterations were observed; attrition, secondary dentine deposition, recession of the gingiva, cementum apposition, root dentine transparency and root resorption. The reliability of this technique has been further supported by Johanson.[8] Increasing attention has been directed at root dentine transparency which occurs independent of any pathological process affecting the tooth. In recent years, there has been great interest in the changes of the chemical composition of teeth. It has been reported that aspartic acid in tooth enamel and dentine exhibit increasing racemization with age. This reaction was found to be a good biochronological tool for assessing age and further research is being done in this area.[9,10]

Third molar as an indicator of age

The dental age can be assessed amongst young children with greater accuracy. This is because many teeth are undergoing development and calcification simultaneously. However, after the early teens most teeth have calcified and erupted except for the third molars. This makes the third molar development the most important choice for age assessment from the late teens to the early twenties. Furthermore, the use of other biological indicators such as epiphyseal fusion, changes of the pubic symphysis, wrist bones and fusion of cranial sutures are not credible during these years. Therefore the third molars become most useful when there is a need to determine the juvenile or adult status of an individual when no valid document with the recorded age is available. Furthermore, this form of age estimation can be applied to assess the age of a patient suffering from amnesia and also specimens of forensic or anthropological importance.

Address for correspondence and reprint requests: Dr. Phrabhakaran Nambiar, Dean's Office, Faculty of Dentistry, University of Malaya, 59100 Kuala Lumpur, Malaysia.

The third molar is very variable in position, anatomy and timing of development. Sometimes it does not exist at all. It may even be larger than the 1st and 2nd molar with the roots fused and delineated by vertical grooves. The maxillary molar generally consists of 3 cusps, whereas some exhibit 4 cusps. In the mandible, the variability is between 4 or 5 cusps.[11] It is noticed that the third molar formation and eruption occur faster in males than in females.[3,12] This is opposite to the development of the other teeth where girls have earlier development.

CASE REPORT

In July 1993, an unknown murdered male was examined whose facial features, skin color and dentition were suggestive that he was an Indo-European. On examination of his teeth, it was observed that the 3rd molars were clinically absent. As dental x-ray's facilities were not available, a lateral oblique view of the mandible was taken to study the third molar development (Fig.1). The third molar crown was complete and more than 2/3 of the roots formed. In accordance to the chart of Demirjian *et al*, (Fig.2) the morphology matched with stage F (advanced) wherein the root length was greater than the crown height but the apical ends of the roots were patent. This finding was subsequently compared with Table 1 provided by Mincer *et al*.[13] Stage *F* of mandibular third molar development had a mean age of 17.5 years with a range of 15.4 and 19.6 years at one standard deviation. As the morphology of the tooth formation of the deceased was advanced F stage, the probability of the person being older than 17.5 years was possible. The deceased when he was identified subsequently (from fingerprints) was 18 years and 11 months of age on the day he was examined postrnortem. His date of birth was obtained from his identification papers.

DISCUSSION

Although Demirjian *et al*[5] provided an excellent method of age estimation from the radiological appearance of mandibular teeth, the age range was only between 3 and 17 years. Third molar development was not included in their investigations. It was only Moores *et al*[2] and Schour & Massler[4] and the detailed work by Mincer *et al*[13] that provided a favourable study of the age related stages of development of these teeth. All the third molar teeth were not present clinically in the deceased during oral examination. The third molars are prone to impaction as they are the last teeth to form and erupt. According to Moores *et al*,[2] these teeth erupt when the roots are 3/4 formed. That is the reason why x-rays should be taken during every examination. Furthermore, greater accuracy of age estimation is possible when the estimation is based on the stage of development and not merely on the emergence of

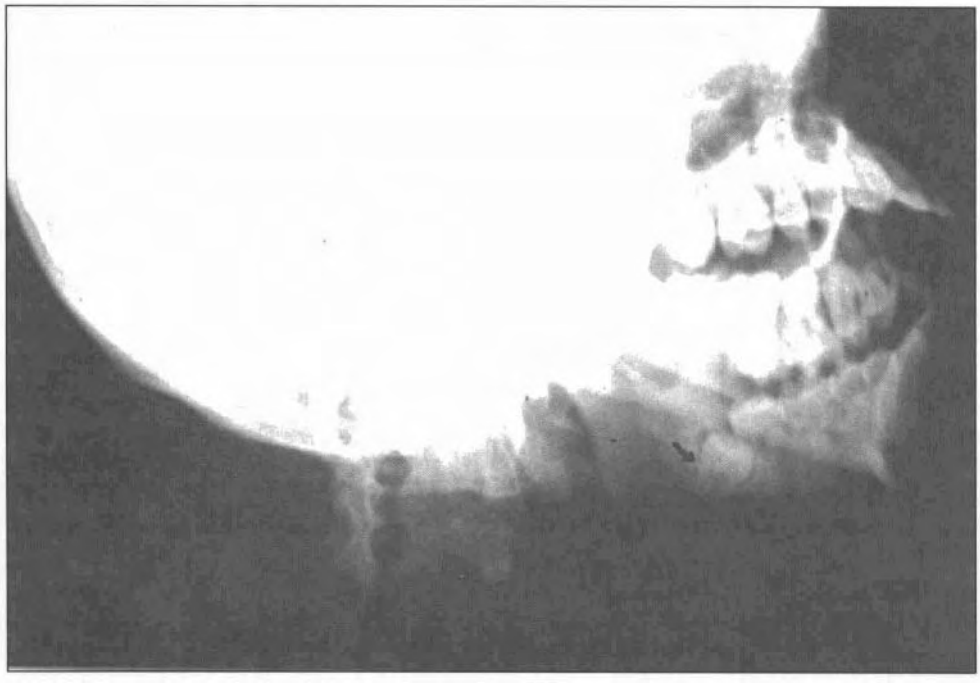

FIG. 1: Lateral oblique view of the deceased showing the developing third molar.

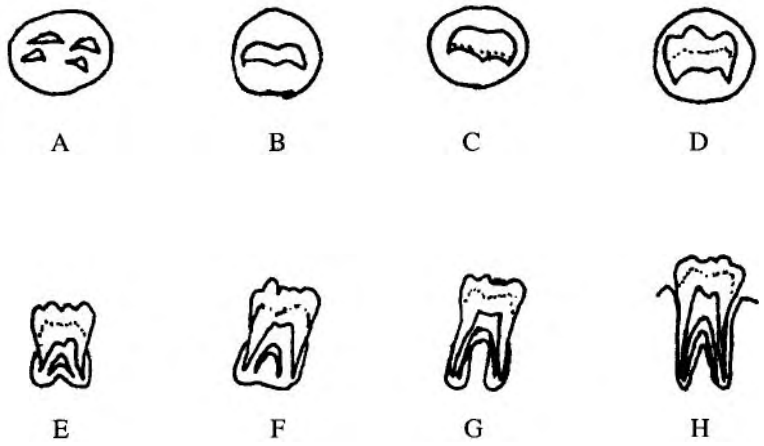

FIG. 2: Schematic drawing of the eight stages of crown - root formation of the molars as proposed by Demirjian et al[5].

TABLE 1: Mean ages at attainment of stages of third molar crown-root formation (according to Mincer et all[3])

GRADE OF FORMATION		D	E	F	G	H
MAXILLA						
Males	x	16.0	16.6	17.7	18.2	20.2
	sd	1.97	2.38	2.28	1.92	2.09
Females	x	16.0	16.9	18.0	18.8	20.6
	sd	1.55	1.83	1.95	2.27	2.09
MANDIBLE						
Males	x	15.5	17.3	17.5	18.3	20.5
	sd	1.59	2.47	2.14	1.93	1.97
Females	x	16.0	16.9	17.7	19.1	20.9
	sd	1.64	1.75	1.80	2.18	2.01

the tooth in the oral cavity.

The table provided by Mincer ***et al***[13] is for Caucasoids, which strongly relates to the racial origin of the deceased who has been identified as an Indian. However, it is not known if the table is suitable for the Mongoloid population. Furthermore, the maxillary third molar tends to develop somewhat faster than their mandibular counterparts.'' It is therefore necessary to examine third molars from both the maxilla and mandible to provide a better estimation of the chronological age than using them singly.

Third molar growth and calcification are definitely not the favourite development marker. However, it is suitable because there are no other favourable indicators during the late teens and early twenties. The reliability of using this to distinguish juvenile versus adult individuals is questionable. It can be applied selectively when the extreme ranges of the tooth development are considered. That is to say that at stage A-D, a person will probably be below 18 years and at stage H an individual will probably be above 18 years.[13]

ACKNOWLEDGEMENTS

Sincere thanks are due to Dr. Zainudin Mohd. Ali, Kuala Pilah district Hospital for providing the x-ray of the deceased.

REFERENCES

1. Altini M. Age determination from the teeth - a review. J Dent Assoc S Africa 1983; 38: 275-8.
2. Moores CFA, Fanning EA, Hunt Jr. EE. Age variation of formation stages for ten permanent teeth. J Dent Res 1963; 42: 1490-502.
3. Anderson DL, Thompson GV, Popovich F. Age of attainment of mineralization stages of the permanent dentition. J Forensic Sci 1976; 21: 191-200.
4. Schour I, Massler M. The development of human dentition. J Am Dent Assoc 1941; 28: 1153-60.
5. Demirjian A, Goldstein H, Tanner JM. A new system of dental age assessment. Hum Bio 1973; 45: 211-27.
6. Demirjian A, Goldstein H. New systems for dental maturity based on seven and four teeth. Annals Hum Bio 1976; 3: 411- 21.
7. Gustafson G. Forensic Odontology. London: Staples Press, 1966: 105-39.
8. Johanson G. Age determinations from human teeth. Odontologisk Revy 1971; 22 (Suppl): 21.
9. Gillard RD, Pollard AM, Sutton PA, Whittaker DK. An improved method for age at death determination from the measurement of D-Aspartic acid in dental collagen. Archaeometry 1990; 32: 61-70.
10. Ohtani S, Yamagishi M, Ogasawara M, Yamamoto K. Age estimation of two unidentified bodies by amino acid racemization in their teeth. Bull Kanagawa Dent Col 1990; 18: 23-7.
11. Berkowitz BKB, Holland GR, Moxham BJ. A colour atlas and textbook of oral anatomy. Holland Wolfe Medical Publications Ltd, 1978: 30-1.
12. Levesque GY, Demirijian A, Tanguay R. Sexual dimorphism in the development, emergence and agenesis of the mandibular third molar. J Dent Res 1981; 60: 1735-41.
13. Mincer HH, Harris EF, Berryman HE. The ABFO study of third molar development and its use as an estimator of chronological age. J Forensic Sci 1993; 38: 379-90.