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Studies of the chronological course of third molars eruption in a northern Chinese population



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ARTICLE INFO

Article history:

Received 12 December 2013

Received in revised form

1 April 2014

Accepted 8 May 2014

Keywords:

Forensic odontology

Age estimation

Tooth eruption

Third molar

Northern Chinese population

ABSTRACT

Dental age estimation is of great importance for individual identification in forensic medicine and many other fields of study. Among them, tooth eruption is a parameter developmental morphology that can be determined by clinical examinations or by dental X-rays. The purpose of present research is to study the chronological course of third molars eruption in a Chinese population and compare that with other ethnic population for age estimation. A total of 1135 conventional orthopantomograms from 506 male and 629 female northern Chinese subjects aged between 11 and 26 years were analyzed. The eruption status of the third molars was assessed using the developmental stages described by Olze et al. Results showed that the third molars 18, 28, 38 and 48 in the stage A showed significant younger average age in males than in females. The Olze's stage A could be used as a reference stage to determine whether a male or female northern Chinese is likely to be equal or above age 16, with 99.6–100% and 97.4–98.1% of correct predictions, respectively. The stage D was found to be a useful marker for diagnosing age under 16 years, with 98.9–100% and 100% of correct predictions in males and females, respectively. There were some significant differences of the chronological course of the third molars eruption in different ethnic groups, which indicated that population-specific standards could enhance the accuracy of forensic age estimation based on third molar eruption.

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<http://dx.doi.org/10.1016/j.archoralbio.2014.05.018>

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1. Introduction

There are many responsibilities and privileges that are legally granted based on an individual's age. Age estimation therefore is often required while administering justice to an individual involved in civil and criminal lawsuits. This has become more and more prominent in China as the growing number of unconfirmed-age subjects migrated from different areas and the growing number of juvenile delinquency.^{1–4} The ages of 14, 16 and 18 are of legal relevance in China.^{5,6} China's civil law consider children over 18 have full civil responsibility. In Chinese criminal law, children under 14 have no criminal responsibility; teenagers from 14 to 16 have limited/partial criminal responsibility; those over 16 have full criminal responsibility. In most European countries, the age of legal importance ranges from 14 to 21 years.^{7–9} Besides the living subjects, the estimation of age on death has also become increasing important in recent years. For some criminal cases and very mutilated victims of mass disasters, age estimation could provide very useful clues to determine the identity of a dead person from ethical, legal and criminal perspectives.^{10,11}

The recommendations of the Study Group on Forensic Age Diagnostic (SGFAD) for age estimations in living individuals in criminal proceedings are physical examination, X-ray examination of the left hand, and dental examination with the determination of the dental status and X-ray examination of the dentition. If the skeletal development of the hand is completed, and additional radiological examination of the clavicles should be carried out.¹² Among them, it is generally accepted that the development of third molars is the most reliable method to estimate the adolescents and young adults' chronological age. As comparing with other permanent teeth, the development of third molars tends to continue over a longer time period and until a later age.¹³

Tooth eruption, unlike tooth mineralization, is a parameter developmental morphology which can be determined by clinical examinations and/or by dental X-rays.¹⁴ Through evaluating third molar eruption, many previous studies based on different populations have demonstrated that there is a good correlation between the emergence of third molar and the chronological ages of the early adolescents. And the influence raised from ethnic origin on the chronological course of third molar eruption also be found.^{15–18} However, after reviewing the literature, no report is seen on the research of assessing the development of third molar eruption in Chinese population. China is one of the widest countries in the world with a large population. It, therefore, would be very meaningful to estimate the chronological age by evaluating the radiographic features of third molar eruption among the adolescents and young adults living in different parts of China. In the present study, the chronological age based on third molar eruption in northern China is studied, and a comparison of our results with that of the previous studies on four ethnic populations (including Japanese, South African, German and Canadian) is performed.^{7,15–17}

2. Materials and methods

A total of 1135 conventional orthopantomograms from 506 males and 629 females northern Chinese subjects aged between 11 and 26 were analyzed. All the subjects were divided into 16 groups. In age group 13, the patients of ages ranging from 13.00 to 13.99 were involved and so on. The age and sex distribution of the study population were shown in Table 1. The orthopantomograms were chosen from the Department of Oral Radiology, the Affiliated Stomatological Hospital of Xi'an Jiaotong University Health Science Center, China, from February 2012 to May 2013. Identification number, sex, date of birth, date of exposure, and eruption stages of the third molars of each patient were recorded.

The tooth eruption status of the third molars was assessed using the classification of stages defined by Olze et al.¹ (Fig. 1):

- Stage A: Occlusal plane covered with alveolar bone.
- Stage B: Alveolar emergence; complete resorption of alveolar bone over occlusal plane.
- Stage C: Gingival emergence; penetration of gingival by at least one dental cusp.
- Stage D: Complete emergence in occlusal plane.

Exclusion criteria were as follows: (1) Impacted wisdom and wisdom teeth with an unclear direction of emergence. Mesially, distally and vestibulo-orally angulated third molars were classified as impacted.^{19,20} (2) Any medical or surgical disease that could affect the eruption of third molars. (3) Orthopantomogram showing obvious dental pathology, such as a third molar dentigerous cyst. All digital radiographs were viewed by the same observer to eliminate potential inter-examiner error.

All statistical analyses were performed using SPSS 13.0 for Windows. To test intra-examiner reliabilities, the author staged the eruption of teeth on an independent 100 randomly

Table 1 – Age and sex distribution of the sample.

Age (years)	Male	Female
11	66	68
12	70	84
13	58	63
14	49	59
15	30	47
16	18	26
17	10	15
18	18	13
19	17	17
20	16	30
21	23	39
22	36	39
23	25	30
24	26	33
25	24	38
26	20	28
Total	506	629

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