



Accuracy of Cameriere's third molar maturity index in assessing legal adulthood on Serbian population



Ksenija Zelic^a, Ivan Galic^b, Nenad Nedeljkovic^{c,*}, Aleksandar Jakovljevic^d,
Olga Milosevic^c, Marija Djuric^a, Roberto Cameriere^e

^aUniversity of Belgrade School of Medicine, Laboratory for Anthropology, Institute of Anatomy, Dr Subotica 4, 11000 Belgrade, Serbia

^bUniversity of Split School of Medicine, Departments for Research in Biomedicine and Health and Dental Medicine, Spinčićeva 2, 21000 Split, Croatia

^cUniversity of Belgrade School of Dentistry, Clinic for Orthodontics, Gastona Gravijeva 2, 11000 Belgrade, Serbia

^dUniversity of Belgrade School of Dentistry, Clinic for Oral Surgery and Implantology, Serbia

^eAgEstimation Project, Institute of Legal Medicine, University of Macerata, Macerata, Italy

ARTICLE INFO

Article history:

Received 16 October 2015

Received in revised form 15 December 2015

Accepted 16 December 2015

Available online 31 December 2015

Keywords:

Age estimation

Third molar

Panoramic radiograph

Legal adulthood

ABSTRACT

At the moment, a large number of asylum seekers from the Middle East are passing through Serbia. Most of them do not have identification documents. Also, the past wars in the Balkan region have left many unidentified victims and missing persons. From a legal point of view, it is crucial to determine whether a person is a minor or an adult (≥ 18 years of age). In recent years, methods based on the third molar development have been used for this purpose.

The present article aims to verify the third molar maturity index (I_{3M}) based on the correlation between the chronological age and normalized measures of the open apices and height of the third mandibular molar.

The sample consisted of 598 panoramic radiographs (290 males and 299 females) from 13 to 24 years of age. The cut-off value of $I_{3M} = 0.08$ was used to discriminate adults and minors.

The results demonstrated high sensitivity (0.96, 0.86) and specificity (0.94, 0.98) in males and females, respectively. The proportion of correctly classified individuals was 0.95 in males and 0.91 in females.

In conclusion, the suggested value of $I_{3M} = 0.08$ can be used on Serbian population with high accuracy.

© 2015 Elsevier Ireland Ltd. All rights reserved.

1. Introduction

Determining chronological age of an individual in physical anthropology, forensic and legal practice still attracts the attention of researchers, although many methods have already been established [1]. Apart from the physical examination and measurement of the puberty development, many of the methods are based on the analysis of bones and teeth [2–8]. For non-adults, the most reliable are the methods based on teeth development [2,3]. The widely used method by Demirjian is based on tooth formation in the bone of the first seven lower permanent teeth [2]. This method was later adjusted for European population and

simplified by Willems et al. [3]. However, as the dentition finishes growth and development by the age of 15, it is not possible to apply this method on older individuals. This is also true for the method based on the development of the hand and wrist bones [5]. When the formation of these bones is completed, clavicle formation should be additionally analyzed [5].

When it comes to individuals older than 14 years of age, there is a lack of methods which could estimate a person's age with high probability. Moreover, from a legal point of view, one of the most important questions is whether a person is a minor or an adult (i.e., older or younger than 18 years of age). As the wisdom teeth are the only teeth in human dentition that are still not fully formed after the age of 18, many studies focused on its development. In 1993, Mincer et al. [9] published a study in which they used lower wisdom teeth development in establishing whether a person is an adult or a minor. This approach used Demirjian's staging system (DSS), which recognizes eight stages of development, from the crypt stage to the closed apices [2]. The goal was to provide an estimation of whether an individual is a minor or an adult if the

* Corresponding author.

E-mail addresses: ksenijazelic@gmail.com (K. Zelic), igalic@mefst.hr (I. Galic), nenad.nedeljkovic@stomf.bg.ac.rs (N. Nedeljkovic), dr.sasuli@hotmail.com (A. Jakovljevic), milosevic.olga@yahoo.com (O. Milosevic), marijadjuric5@gmail.com (M. Djuric), roberto.cameriere@unimc.it (R. Cameriere).

third molar has been developed to a certain stage. Later on, this staging system (DSS) with or without modifications [10,11], as well the staging system of Moorrees et al. [12], was used by several authors, in order to verify the applicability of this approach on different populations [13,14].

Recently, a completely new approach was published [15] based on the correlation between normalized measures of the open apices and the height of the third molar-third molar maturity index (I_{3M}). Although being verified on only a few populations so far, this approach was found to be very applicable and even more accurate than the previous one [16–19]. However, there is a need for further testing of the proposed method on different populations because there are always differences between populations in anthropologic features, including tooth development [12].

In the Republic of Serbia, there is a great need for relevant and accurate methods for age estimation. This is a country with a very turbulent history as both World Wars took place on its territory, leaving many unidentified victims [20]. This is even more important due to recent wars in the Balkan region which also left many missing persons and refugees [20]. Furthermore, because of the low socio-economic status, people from Serbia often seek asylum in the countries of the European Union and problems occur when the age of an individual cannot be established [21]. It is even more important if a person cannot be classified in the minor or adult group. It is highly important to establish a valuable method for this classification, especially because extremely high number of refugees from the Middle East are passing through Serbia and moving toward EU countries [22]. Most of them do not have any personal documents.

In the previous work [23], where the accuracy of Demirjian's and Willems' methods on Serbian population was analyzed, some differences in comparison to other population from Europe or even Balkan regions were found [24–27]. Thus, it is important to verify third molar maturity index (I_{3M}) on Serbian populations so that it can be used for the purpose of identification or in the legal and criminal procedures to determine if a particular person is a minor or an adult.

2. Materials and methods

The study was conducted on contemporary Serbian population. Digital panoramic radiographs of healthy individuals were selected randomly from the patients' database of the Department for Orthodontics, School of Dentistry at the University of Belgrade, with the approval of the School's Ethics Committee and in accordance with ethical principles for medical research involving human subjects stated in the Declaration of Helsinki [28]. The exclusion criteria for individuals were: missing lower third molars, those with serious deformities, dental trauma (which was established from the personal dental records) and unclear radiographs. The final sample included 589 participants (290 male and 299 female) with an age range from 13 to 24 years (Table 1). The study included patients who underwent radiological examination from 2009 until 2015. The chronological age of each subject was calculated as the difference between the date on which the radiograph was made and the date of birth and converted into decimal ages. The age of each subject was not known to the investigator during the measurements.

After training and calibration, the first two authors assessed all radiographs. The measurements on the panoramic radiographs were performed using image processing program ImageJ [29]. The distance between the inner sides of the open apex (A) of mandibular left third molars was measured and divided by the tooth length (I). If the tooth had two roots (A1 and A2), the sum of these distances of both roots (A1 + A2) was divided by the tooth length (I) [15], Fig. 1.

Table 1

Age and sex distribution of panoramic radiographs from Serbia in which numbers in parenthesis represents the number of participants with closed apices of the left third mandibular molar ($I_{3M} = 0.00$).

Age (years)	Males	Females	Total
13	23	28	51
14	26	28	54
15	24	22	46
16	25	25	50
17	24(1)	26(1)	50 (2)
18	23(5)	23(4)	46 (9)
19	23(8)	25(7)	48 (15)
20	26(12)	28(14)	54 (26)
21	27(18)	23(13)	50 (31)
22	23(16)	22(16)	45 (32)
23	24 (24)	24(20)	48 (44)
24	22 (22)	25(22)	47 (44)
Total	290 (106)	299 (97)	589 (203)

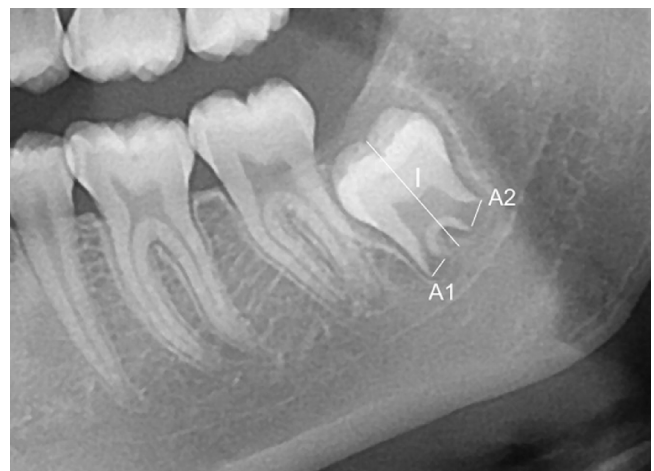


Fig. 1. Third molar maturity index (I_{3M}) is proportion of the sum of open apices (A1 + A2) and height (I) of the projection of the third molar on a panoramic radiograph.

The resulting number was defined as the third molar maturity index (I_{3M}). If the apex of the third molar was completely formed than $I_{3M} = 0.00$. Briefly, I_{3M} was evaluated in a similar way to the ratio A_i to L_i as reported for the mandibular teeth with two roots (A_i , $i = 6, 7$) [30]. Both erupted and non-erupted third molars were included in this study.

The test of the feasibility and reproducibility of the applied methods involved 60 radiographs (10% from each age category) which were randomly selected and reassessed by the same authors two months after the initial assessment. Therefore, to evaluate intra-observer agreement of I_{3M} , intra-class correlation coefficient (ICC) was calculated. Cohen's Kappa test was then applied following the instructions of Ferrante et al. [31] for intra-rater and inter-rater agreement of discriminating those who are 18 years or older and those who are younger than 18 years.

To test the performance of the cut-off value of $I_{3M} = 0.08$, the results were summarized in a single table which consisted of separate 2×2 contingency tables for each gender [13]. Generally, 2×2 table displayed the number of participants who had $I_{3M} < 0.08$ and are 18 years and older or true positives, then the participants with $I_{3M} < 0.08$ who were younger than 18 years or false positives, followed by those with $I_{3M} \geq 0.08$ who are 18 years and older or false negatives and finally those with $I_{3M} \geq 0.08$ who were younger than 18 years or true negatives. The results of the 2×2 test were presented with 95% confidence interval (95% CI).

Download English Version:

<https://daneshyari.com/en/article/6551868>

Download Persian Version:

<https://daneshyari.com/article/6551868>

[Daneshyari.com](https://daneshyari.com)