



Third molar cut-off value in assessing the legal age of 18 in Saudi population



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ABSTRACT

Teeth plays a major role in forensic sciences especially in age assessment of an individual, which can be used to aid in criminal or civil matters. The importance of teeth comes from their ability to survive inhumation well and because they are hardly affected by exogenous and endogenous factors. Third molars are the only teeth still developing after the age of 14 years and during the legal age of adulthood, which is 18 years. The consequences of criminal violation can strongly affect the individual's life, it is important to set different parameters to decide whether an individual is a minor or an adult in the absence of documents. Depending on the different legal requirement, such parameters can set above 90% probability for criminal matters and from 51% to civil matters.

Aim: The aim of this research was to find the cut-off value of third molar development for the legal age of 18 amongst Saudi individuals using the third molar maturity index method by Cameriere et al. (2008) [17].

Materials and methods: This was a cross sectional study on 300 archived orthopantomogram (OPG) of healthy Saudi patients between the ages 14 and 22 years attending the Dental Hospital at King Saud University, Riyadh, Saudi Arabia. All OPGs were taken by PLANMECA – ProMax machine and evaluated by the Romaxis software. The inclusion criteria were good quality OPGs taken during the course of treatment. All patients were healthy with no systemic diseases or disorders with the presence of third molars and clear root apex.

The lower left mandibular third molar (LL3rdM) was assessed using third molar maturity index (I3m) to determine if the individual is younger or older than 18 years old.

Results: The cut-off value of I3m for the Saudi population was (I3m < 0.08). The sensitivity of this method was 51.7% and the specificity was 98.5%. Early mineralization was found in males except when I3m was ranging from (0.0 to 0.4) and (0.9 to 1.7). Cameriere et al. (2014, 2008) [16,17] test was reproducible with good measure of reliability.

Conclusion: This method is suitable for assessing the attainment of legal age of adulthood in Saudi population and the cut-off value of I3m is similar to other populations. Although dental age assessment by means of third molar development is useful, it still has its limitation because of its variation in position, morphology and development.

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1. Introduction

Determining the age of an individual is a fundamental objective in forensic and legal sciences. Legal documents, such as birth certificates, provide the accurate age for individuals, but in the absence of documents, age estimation using biological indicators:

physical or radiographic examination or combination of both is vital [1,2].

Teeth are important in age estimation of both the living and the dead. Dental development, dentin and cementum deposition and pulp changes can be utilized for that purpose.

Some techniques may require the use of extracted teeth to perform the analysis, others rely on radiographic interpretation which is most useful in the living [3].

The cut-off point between childhood and adulthood is the age of (18 years) [4]. This age of legal responsibility is becoming increasingly important, especially with the influx of illegal

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migration and the presence of large numbers of displaced people from their homes due to armed conflicts without their legal documents. Age estimation methods that rely on bone development are not very useful in that age group because most of the bones have been fused by that age or require extensive amount of radiation to examine it [5].

Wealth, work opportunities and its religious status make Saudi Arabia a hub for people from around the world. Although immigration is illegal [6], many people try to enter the country illegally from neighboring troubled countries and from Africa. The latest records in 2014 reveal that there are 194,520 illegal immigrants [7].

Although Saudi Arabia has a relatively low crime rate [8], it is still faced with challenges in regard to human identification and age estimation, given its special circumstances: the unregistered births in rural areas and numbers of illegal immigrants, which is on the increase, makes the need for age estimation crucial. Most of these cases come to surface during trial to determine whether an individual is 18 years or older.

Cameriere et al. developed a method using the third molar maturity index to assess the age among Caucasians. Few studied have tested this method on different population [9–16], but none was done on Saudi population [17].

The aim of this research was to find the cut-off value of third molar development for the legal age of 18 years amongst Saudi individuals using Cameriere et al. [17] method.

2. Materials and methods

This was a retrospective cross sectional study on 300 archived Othopantomograms (OPG) of healthy Saudi patients between the ages 14 and 22 years attending the Dental Hospital at King Saud University, Riyadh, Saudi Arabia. All OPGs were taken by PLANMECA – ProMax machine and evaluated by the Romaxis software.

The inclusion criteria were good quality OPGs taken during the course of treatment. All patients were healthy with no systemic diseases or disorders and have the third molars with clear root apices on the radiograph. Exclusion criteria were unclear OPGs, any gross caries or periapical pathosis or abnormality in the 3rd molars and/or any history of orthodontic treatment. No radiographs was taken for the purpose of this study.

The lower left mandibular third molar (LL3rdM) was assessed using third molar maturity index (I3m) to determine if the individual is younger or older than 18 years old (Cameriere et al. [17]) as follows:

If the LL3rdM had a complete closed apex, then the third molar maturity index (I3m) will be 0. If the root is still developing, then the I3m will be the sum of the distances of the inner sides of the open apex of both the mesial and distal roots (A+B) divided by the tooth length from the highest cusp tip (C) ($I3m = A + B/C$) (Fig. 1).

According to Cameriere et al., the cut-off value of an individual considered to be 18 years of age or older is when $I3m < 0.08$ [17]. Accuracy of age estimation was measured by bias, which is the mean difference between Estimated Age (EA) and the Real chronological Age (RA) using t-test ($P < 0.05$). All data management and analysis were done using SPSS-version-20.

2.1. Intra- and inter-examiner reliability

A random 10% sample of OPGs was assessed by the same researcher twice in an interval of 1 week to examine the intra-examiner reliability and the same radiographs were also assessed by the other examiner to test the inter-examiner reliability. All tests were done using Cohen's Kappa [18].

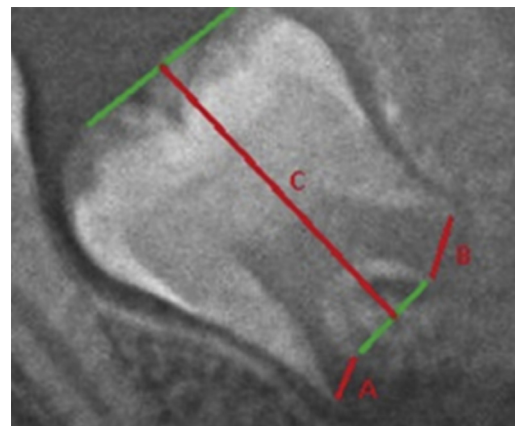


Fig. 1. Third molar measurements adapted from Cameriere et al. [17]. (A and B) are the widths of the inner sides of the open apex of the mesial and distal roots respectively. (C) is the tooth length from the highest cusp tip.

3. Results

During the process of data collection and analysis of the radiographic images, no ethical issues or protocols were validated, since all OPGs were obtained from archived data and no patient received any unnecessary ionizing radiation other than the main therapeutic purposes [19].

The kappa test revealed excellent reliability (Intra-examiner agreement 0.84 and inter-examiner agreement 1.00).

Table 1 shows the age and sex distribution of the tested sample. There were 127 males (46.69%) and 145 females (53.31%). The mean chronological age with the standard deviation for each 3rd molar maturity index (I3m) is shown in (Table 2) for both males and females.

When I3m was between (0.0 to 0.04), the mean age among males and females was 21.346 years (± 1.1204) and 20.966 years (± 1.235 year) respectively and when I3m was < 0.04 , 90% of individuals of both genders were 20 years or older.

Half of the individuals with I3m between (0.04–0.08) were 20 and 21 years.

Among the male and female subjects that have I3m (0.08–0.3), 65% were under 18 years of age and among the males and female subjects, 50% of the sample with I3m (< 0.3 –0.5) were 17 and 16 years of age. Whereas 85% that presented an I3m (≤ 0.5) were 16 years old and younger.

Table 3 shows the contingency data describing discrimination performance of the test for males and females. Thirty four males (52.3%) and 40 females (51.3%) that were ≥ 18 year of age were correctly classified when $I3m < 0.08$ (sensitivity) with a 95% confidence interval. The specificity, on the other hand, was 62

Table 1
Age and sex distribution of the study sample.

Age group (years)	Gender		Total
	Males	Females	
14	12	10	22
15	18	18	36
16	17	16	33
17	14	20	34
18	13	14	27
19	12	14	26
20	16	19	35
21	13	19	32
22	11	12	23
Total	127	145	272

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