Genders identification using mandibular canines
(Iraqi study)

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ABSTRACT

Background: This study aimed to determine the gender of a sample of Iraqi adults using the mesio-distal width of mandibular canines, inter-canine width and standard mandibular canine index, and to determine the percentage of dimorphism as an aid in forensic dentistry.

Materials and methods: The sample included 200 sets of study models belong to 200 subjects (100 males and 100 females) with an age ranged between 17-23 years. The mesio-distal crown dimension was measured manually, from the contact points for the mandibular canines (both sides), in addition to the inter-canine width using digital vernier. Descriptive statistics were obtained for the measurements for both genders; paired sample t-test was used to evaluate the side difference of mandibular canines in both genders, independent samples t-test was performed to evaluate the gender difference in addition to the percentage of dimorphism and percentages of correctly classified and misclassified cases using the standard mandibular canine index.

Results: The mesio-distal widths of the mandibular canines were non-significantly slightly larger in males than females, while the inter-canine width was larger in males than females with a high significant difference. The accuracy of genders determination using standard mandibular canine index was 32% for males, 59% for females and 45.5% for the combined sample. The percentages of dimorphism were 0.58% for the canine mesio-distal width, 3.99% for the inter-canine width and 3.85 for the mandibular canine index.

Conclusions: The mandibular inter-canine width and mandibular canine index gave better percentage of dimorphism than the mesio-distal width of mandibular canines. On the other hand, standard mandibular canine index showed low accuracy for gender determination.

Keywords: Canine width, inter-canine width, standard mandibular canine index, forensic dentistry. **(J Bagh Coll Dentistry 2014; 26(1):150-153).**

INTRODUCTION

Teeth, in the living as well as the dead, are the most useful objects in the field of forensic investigation. Their ability to survive in situations like mass disasters makes them important tools in victim identification. Though the morphology and structure is similar in both men and women, there are subtle differences. Variation in dental size can give a clue about differences between the sexes [1].

Canines are perhaps the most stable teeth in the oral cavity because of the labio-lingual thickness of the crown and the root anchorage in the alveolar process of the jaws. The crown portions of the canines are shaped in such a manner as to promote cleanliness. This self-cleansing quality and efficient anchorage in the jaws tend to preserve these teeth throughout life [2]. These findings indicate that canines can be considered the 'key teeth' for personal identification [3].

Regarding the forensic dentistry, the mandibular canine widths and inter-canine width and the ratio between them (mandibular canine index) alone or in combination were used in many studies [3-11].

In Iraq, genders identification was studied using the radiographs [12,13] and the C.T. scan [14] or with the aid of study models [15-17]. This study is the first in Iraq that determine the genders using the mandibular canines.

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MATERIALS AND METHODS

Sample

The study sample consisted of 200 sets of study models belong to 100 males and 100 females selected from the students of the College of Dentistry, University of Baghdad and some secondary schools based on the following criteria:
1. The age ranged between 17-23 years.
2. All of the subjects had complete set of fully erupted teeth regardless the wisdom teeth.
3. The mandibular anterior teeth were intact, caries-free, well aligned with no signs of attrition, mobility or gum recession and no history of orthodontic treatment.

Methods

After the clinical examination of all subjects, dental impressions for the maxillary and mandibular arches were taken with alginate impression materials. A study models were constructed after pouring the impressions with dental stone. The maximum mesio-distal crown widths of mandibular canines were measured from the anatomical contact points [18] using digital sliding caliper gauge with the pointed beaks inserted in a plane parallel to the long axis of the tooth. The measurements were made to the nearest 0.01 mm. The inter-canine width or distance was measured from the canine tip to the canine tip on the other side with same caliper gauge [4].

Mandibular Canine Index (MCI) was first measured by Rao *et al.* [4] and calculated by

dividing the mesio-distal width of the mandibular canine by the inter-canine distance.

Based on these values, the standard MCI was derived as follows [4]: Standard MCI =

$$\frac{(\text{Mean males MCI - SD}) + (\text{Mean females MCI + SD})}{2}$$

Statistical analyses

All the data of the sample were subjected to a computerized analysis using SPSS program version 19. The statistical analyses included:

- Descriptive statistics: means, standard deviations, frequency, percentages and statistical tables.
- Inferential statistics: Paired sample t-test to evaluate the side difference in the width of canines in both genders. Independent sample t-test to evaluate the genders difference. Percentage of dimorphism which is the percentage by which the tooth size of males exceeds that of females {it equals to = [(Xm/Xf)-1x100] where Xm is the mean tooth dimension of males and Xf is the mean tooth dimension of females} [19].

In the statistical evaluation, the following levels of significance were used:

P > 0.05	**NS**	**Non-significant**
0.05 ≥ P > 0.01	**S**	**Significant**
P ≤ 0.01	**HS**	**Highly significant**

RESULTS

Table 1 demonstrated the difference between the right and left mandibular canine widths in both genders. The results showed non-significant side difference.

Table 1. Descriptive statistics, sides' differences of the width of mandibular canines (mm.)

Genders	Side	Descriptive statistics		Side difference	
		Mean	**S.D.**	**t-test**	**p-value**
Males	**Right**	6.90	0.44	-1.04	0.301 (NS)
	Left	6.93	0.46		
Females	**Right**	6.88	0.62	-0.42	0.678 (NS)
	Left	6.89	0.57		

Table 2 showed the genders differences regarding the canines' widths, inter-canine width and mandibular canine index. Generally, there was non-significant gender difference regarding the widths of the canines, but there was significant gender difference in inter-canine width and mandibular canine index. The percentages of dimorphism were high in inter-canine width and mandibular canine index in accordance with the gender difference.

Table 2. Descriptive statistics, genders' differences and percentage of dimorphism for the measured variables (mm.)

Variables	Genders	Descriptive statistics		Genders difference		Percentage of dimorphism
		Mean	**S.D.**	**t-test**	**p-value**	
Right Canine (RC)	**Males**	6.90	0.44	0.355	0.723 (NS)	0.29
	Females	6.88	0.62			
Left Canine (LC)	**Males**	6.93	0.46	0.579	0.563 (NS)	0.58
	Females	6.89	0.57			
Mean of Both Canines	**Males**	6.92	0.43	0.474	0.636 (NS)	0.58
	Females	6.88	0.58			
Inter-canine Width (ICW)	**Males**	27.61	2.25	3.309	0.001 (HS)	3.99
	Females	26.55	2.30			
Mandibular Canine Index (MCI)	**Males**	0.252	0.02	-2.45	0.015 (S)	3.85
	Females	0.261	0.03			

Table 3 demonstrated the frequencies and percentages of correctly classified and misclassified cases using the standard MCI. The value of this index was 0.26 after calculation from the equation above. Generally, females showed good percentage in genders identification than males.

Table 3. Frequencies and percentages of correctly and misclassified cases using standard mandibular canine index

Genders	Frequencies and percentages of correctly classified cases	Frequencies and percentages of misclassified cases
Males	32 (32%)	68 (68%)
Females	59 (59%)	41 (41%)
Total	91 (45.5%)	109 (54.5%)

DISCUSSION

In this study, mandibular canines were chosen because Hashim and Murshid [20] found that the canines were the only teeth that exhibit dimorphism. Subjects with age ranged from 17 to 23 years were selected since attrition is minimal in this age group and the eruption of canines and growth in width of both the jaws, including the width of the dental arches, are completed [21].

The results showed non-significant side difference between the right and left canines (table 1); this comes in agreement with many studies [5-11]. This means that any measurement of mandibular canine on one side could be truly representative when the corresponding measurement on the other side was unobtainable [22].

The findings in the present study showed that the males had slight larger canine widths with a non-significant difference (table 2). This agrees with Boaz and Gupta [7] and disagrees with the other studies [5,6,8-11] that found significant gender difference in mandibular canines widths. This may be attributed to the sample size or the difference in the ethnic groups.

The mean canine width was non-significantly higher in males than females (table 2); this comes in accordance with Hosmani et al. [11].

In the present study, males have higher inter-canine width than females with a high significant difference (table 2). This comes in agreement with many studies [5,6,8,9] while disagrees with Vishwakarma and Guha [10] and Hosmani et al. [11].

Regarding the mandibular canine index (MCI), this index was higher significantly in females (table 2). Previous studies [5,6,8,9] showed significantly higher MCI in males. Vishwakarma and Guha [10] and Hosmani et al. [11] revealed non-significant gender difference.

The percentage of dimorphism (table 2) was very low for the width of the mandibular canines. This is normal result due to slight width difference. This finding disagrees with other findings [1,3,10]. On the other hand, the inter-canine width and MCI showed marked dimorphism in comparison with the canine widths.

The frequencies and percentages of correctly classified and misclassified cases using the standard mandibular canine index were presented in table 3. The value of this index was 0.26. Value of mandibular canine index above 0.26 was classified as male and equal to and less than 0.26 was classified as female. In this study, the percentages of gender identification accuracy using standard mandibular canine index were 32% for males, 59% for females and 45.5% for the combined sample. These percentages are near to that of Srivastava [8] and Hosmani et al. [11] who could not yield high level of gender determination accuracy. The probable reason for low accuracy could be due to the evolutionary changes, the genetic factors or the ethnic background.

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