A Radio-Odontometric Analysis of Sexual Dimorphism in First Molars Using Cone-Beam Computed Tomography

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Objective: Different techniques for sex prediction are developed and used in the forensic medicine field. One of these methods is based on the teeth morphometry. The aim of the present study was to evaluate the degree of sex determination of the maxillary and mandibular first molar teeth in cone beam computed tomography images.

Method and Materials: This study was carried out on cone beam computed tomography images of 100 men and 100 women with a mean age of 21.28 ± 2.47 years. The roof, floor and height of pulp chamber, as well as marginal enamel thickness and dentin thickness at the height of contour, tooth width, and crown length were measured. Student *t* test and discriminant analysis were applied to assess the differences in the measured parameters between men and women.

Results: According to the present study, the maxillary first molar was more dimorphic than the mandibular teeth. The accuracy of sex identification of mandibular and maxillary first molar tooth was 84% and 77%, respectively. The mesiodistal measured variables were more accurate in sexual differentiation than the buccolingual ones. For sex differentiation, the most dominant variables for maxillary and mandibular first molar teeth were crown height and dentin thickness, respectively.

Conclusions: The first molar tooth showed an acceptable level of sex determination accuracy based on the odontometric measurements.

Key Words: cone-beam computed tomography, sex dimorphism, molar tooth, odontometric, forensic science

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Sex differentiation is crucial in the identification of an individual in a medicolegal investigation. Previous studies have provided several methods for sex discrimination, including DNA analysis, morphological features of the bones and teeth.[1,2] The teeth are highly stable to mechanical, chemical, physical, and thermal insults; therefore, they are a potential source for sex determination when other anatomic structures no longer exist, and DNA tests are impossible.[3,4]

The sexual dimorphism of the first permanent molar is a controversial subject. Several studies have previously revealed a high level of sexual dimorphism for the first permanent molars,[5–7] whereas other researchers have not established such a result.[8,9] Conventional radiographic techniques provide information on the teeth in 2 dimensions. However, cone-beam computed tomography (CBCT) can produce 3-dimensional quantitative data on the tooth dimension, overcoming the conventional technique limitations, such as magnification, geometric distortion, superimposed structures, and inconsistent head position.[10–12] So far, the mesiodistal (MD) tooth dimension has been analyzed quantitatively by several studies based on 2D radiography or buccolingual (BL) dimension on the cast or teeth.[1,13–16] To the best of our knowledge, there is no study differentiating sex based on linear measurements of teeth using CBCT images.

The aim of the present study was to evaluate the degree of sex determination of the maxillary and mandibular first molar teeth in both MD and BL dimensions, using the odontometric parameters of these teeth in CBCT images.

MATERIALS AND METHODS

This cross-sectional study was approved by the institutional ethics committee. Among the patients referred to the oral and maxillofacial radiology department, the CBCTs of 200 patients, including 100 women and 100 men, between the age group of 15 to 25 years with the mean age of 21.28 ± 2.47 years were randomly collected for further analysis. Written consent had been taken at the time of radiographic examination from all the patients for probable use of their anonymous information in future researches. Exclusion criteria were the presence of oral pathologies, facial and oral deformities, and systemic diseases. The first molars with caries and attrition were excluded because they could interfere with the visualization and measurement of the parameters. Only sound and completely developed teeth with closed apices were taken into consideration. The CBCT images were taken using New Tom VGi with the following setting parameters: scan time, 8.9 seconds; 5 mA; 19 mAs; 120 kV. All CBCT images were taken by the same clinician.

To evaluate the tooth dimensions, the corrected sagittal and coronal slices were reconstructed with a slice thickness of 0.3 and a slice interval of 1 mm. On the center of the corrected sagittal and coronal sections, the roof, floor, and height of the pulp chamber, as well as the mesial and distal enamel thickness, dentin thickness at the height of contour (HOC), tooth width at the HOC (WH) and width at cervix (WC) and finally crown length of the upper and lower first molar teeth were measured accurately using CBCT software by an oral and maxillofacial radiologist who was blind to the sex of the patients (Figs. 1–3).

The radiographs, with a 2-week interval between data recording phases, were measured again by the same oral and maxillofacial radiologist to assess the significance of any errors during measurements. Subsequently, to determine the interoperator method error, the radiographs of 20 patients were randomly selected and measured again by another oral and maxillofacial radiologist. Intraobserver and interobserver agreements were assessed using the intraclass correlation coefficient.

Data were summarized using the mean ± standard deviation. Independent sample *t* test and discriminant analysis were used to assess the impact of the measurements on sexual dimorphism. All data were analyzed using IBM SPSS version 22.0 (SPSS

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CONCLUSION

Our data suggested that the first molar exhibited sexual dimorphism. The maxillary first molar was more dimorphic than the mandibular first molar. The MD measured variables were more accurate in sexual differentiation than BL ones. For sex differentiation, the most dominant variables for the maxillary and mandibular first molar teeth were CH and DT on the MD aspect, respectively.

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