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(RESEARCH ARTICLE)

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Mesiodistal and buccolingual crown widths of mandibular molar teeth in adult Sudanese and their clinical correlations

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Abstract

Background and significance: Teeth are the hardest tissues in the human body and preserve their original characteristics for an extended period after death. Measurements of teeth have been used in forensic medicine to determine gender identity, and can help orthodontists and dentistry students with their practical assignments.

Objectives: The purpose of this study was to evaluate the benefits of measuring crown dimensions in the mesiodistal and buccolingual directions in adult Sudanese mandibular molars.

Materials and methods: A total of 120 healthy extracted mandibular molar teeth were collected from 60 male and 60 female Sudanese adults who attended dental hospitals for different molar tooth extraction conditions in Khartoum, Sudan. Each extracted molar tooth was preserved in a bottle containing 200 ml of 10% formalin solution. The crown teeth were measured mesiodistally and buccolingually, using Vernier calipers. The data were analyzed using the SPSS software.

Results: Our findings showed that the mean values of the crown width of the molar teeth were larger for men than that of the females. The mean value of the mesiodistal crown width was wider than that of the buccolingual crown width for mandibular molar teeth of adult Sudanese.

Conclusion: The crown measurements for adult Sudanese molar teeth varied by size and sex, and these variations may be useful in forensic medicine, dental, and orthodontics.

Keywords: Mesiodistal; Buccolingual; Crown widths; Mandibular molars; Sudanese

1. Introduction

In humans, there are three permanent mandibular molar teeth on the right and left sides of the posterior region of the lower jaws. In general, the morphology and morphometric of molar teeth are described using the standard international dental terminology. The surface of the teeth facing the front of the mouth is referred to as the mesial, the surface facing the back of the mouth as the distal, the surface facing the cheek as the buccal, the side facing the tongue as the lingual, the surface facing upward as the occlusal, and the portion of the teeth visible in the mouth as the crown (1). The metric of permanent mandibular molar tooth crown dimensions has been applied in numerous studies on various populations, and the results have demonstrated that it can be helpful in the fields of dentistry and forensic medicine, including gender determination in cases of sudden and unexpected death, food explosions, fires, and accidents (2, 3, 4). The purpose of this study was to assess the advantages of the crown size of the permanent mandibular molar teeth in adult Sudanese.

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2. Materials and methods

A total of 120 sound (not affected by caries) permanent mandibular molar teeth were collected after they were extracted for further pathological reasons from adult Sudanese patients who attended the Dental Hospital in Khartoum state, Sudan. During sample collection, patients' ethical significance was considered.

There were 20 male and 20 female first mandibular molars, 20 male and 20 female second mandibular molars, and 20 male and 20 female third mandibular molars among the extracted molar teeth. A 10% formalin solution (200 mL) was added to each extracted tooth, which was then stored in a plastic box. Prior to extraction from the oral cavity, the teeth name and type of molar teeth were recorded on the outside of each box, in addition to the patient's age and sex.

A Vernier caliper (150X0-05X1\128, Raider, Shanghai, China) was used to measure the metric design in millimeters for each tooth on the crown dimensions mesiodistally and buccolingually (Figures 1 and 2) (4). The Statistical Package for the Social Sciences (SPSS) version 16 (Software Development, Chicago, USA) was used to analyze the crown measurements.

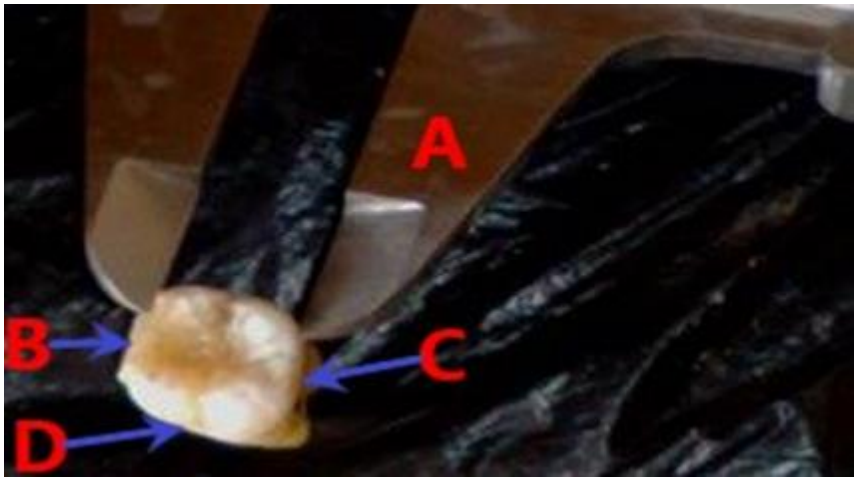

Figure 1 Measurement of mesiodistal crown width of the mandibular molar teeth. A, Vernier caliper; B, distal surface of the crown; C, the mesial surface of the crown; D, crown

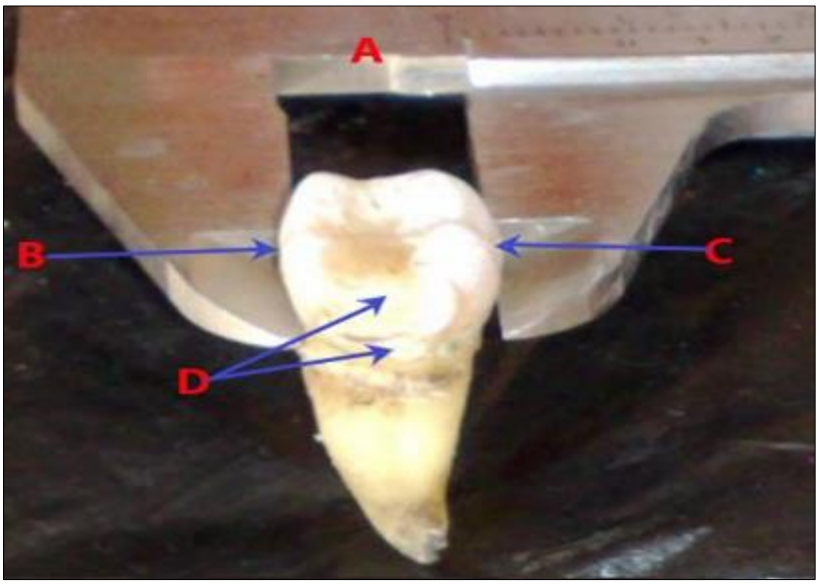

Figure 2 Measurement of buccolingual crown width of the mandibular molar teeth. A, Vernier caliper; B, buccal surface of the crown; C, the lingual surface of the crown; D, crown

3. Results

This study included sixty males and sixty females were involved. The mean and standard deviation of the age distribution was 46.20±15.47 years (range, 21–78 years). The average age was 43.60±16.15 and 48.80±14.70 years for men and women respectively (Table 1). Table 2 presents descriptive statistics on the mesiodistal and buccolingual crown dimensions of the mandibular molar teeth in adult Sudanese. The crown widths of the mandibular molars in the male sample were consistently greater than those in the female sample. In both males and females, the buccolingual mean crown size variability was less than the mesiodistal crown dimension. The first mandibular molar had the largest mean crown width, followed by the second and third molars.

Using the Chi square test, we found that there was no significant difference between the gender or age identification ($p > 0.05$) and the crown dimensions, except for a correlation between gender identification and mesiodistal crown width of the second molar teeth ($p < 0.05$) and the age identification and buccolingual crown size ($p < 0.05$) of the third mandibular molar teeth (Table 3).

Table 1 Demographic data

Gender	Age Mean	N	Age Std. Deviation	Minimum age	Maximum age
Male	43.6000	60	16.15	21.00	78.00
Female	48.8000	60	14.70	24.00	69.00
Total	46.2000	120	15.47	21.00	78.00

N, number**; Std;** standard

Table 2 Descriptive Statistics of crown dimensions in millimeters (mm) of permanent mandibular molar teeth (M1: n=20 male & 20 female, M2: n=20 male & 20 female, M3: n=20 male & 20 female)

Gender	Statistics	MDCWM1	BLCWM1	MDCWM2	BLCWM2	MDCWM3	BLCWM3
Male	Mean	10.81	9.79	10.66	9.44	10.30	9.12
	Std. Deviation	0.96	0.85	0.79	0.94	0.72	0.78
	Minimum	9.20	8.40	9.20	8.00	9.00	7.90
	Maximum	12.50	11.30	12.10	11.00	11.40	10.10
Female	Mean	9.81	9.57	9.64	9.23	9.16	8.98
	Std. Deviation	1.11	0.71	0.85	0.78	0.83	0.75
	Minimum	7.90	8.40	8.30	8.10	7.00	8.00
	Maximum	11.50	11.00	11.10	10.70	10.10	10.00
Total	Mean	10.32	9.68	10.15	9.34	9.73	9.05
	Std. Deviation	1.14	0.78	0.96	0.86	0.96	0.76
	Minimum	7.90	8.40	8.30	8.00	7.00	7.90
	Maximum	12.50	11.30	12.10	11.00	11.40	10.10

*Std, standard; n, number; M1, first molar; M2, Second molar; M3, Third molar; MDCWM1, mesiodistal crown width of the first mandibular molar; BLCWM1, buccolingual crown width of the first mandibular molar; MDCWM2, mesiodistal crown width of the second mandibular molar; BLCWM2, buccolingual crown width of the second mandibular molar; MDCWM3, mesiodistal crown width of the third mandibular molar; BLCWM3, buccolingual crown width of the third mandibular molar.

Table 3 Chi-Square test show a significance of the relationship between gender and age identifications and the crown dimensions

The relationship between gender, age and the crown size	Pearson Chi square
GI&MDCWOM1	0.203
GI&BLCWOM1	0.478
GI&MDCWOM2	0.04
GI&BLCWOM2	0.454
GI&MDCWOM3	0.115
GI&BLCWOM3	0.393
AI&MDCWOM1	0.649
AI&BLCWOM1	0.424
AI&MDCWOM2	0.641
AI&BLCWOM2	0.315
AI&MDCWOM3	0.138
AI&BLCWOM3	0.04

* GI&MDCWM1, Gender identification and mesiodistal crown width of the first mandibular molar; GI&BLCWM1, Gender identification and buccolingual crown width of the first mandibular molar; GI&MDCWM2, Gender identification and mesiodistal crown width of the second mandibular molar; GI& BLCWM2, Gender identification and buccolingual crown width of the second mandibular molar; GI&MDCWM3, Gender identification and mesiodistal crown width of the third mandibular molar; GI&BLCWM3, Gender identification and buccolingual crown width of the third mandibular molar; AI&MDCWM1, Age identification and mesiodistal crown width of the first mandibular molar; AI&BLCWM1, Age identification and buccolingual crown width of the first mandibular molar; AI&MDCWM2, Age identification and mesiodistal crown width of the second mandibular molar; AI& BLCWM2, Age identification and buccolingual crown width of the second mandibular molar; AI&MDCWM3, Age identification and mesiodistal crown width of the third mandibular molar; AI&BLCWM3, Age identification and buccolingual crown width of the third mandibular molar

4. Discussion

Teeth are considered to be the hardest tissues in our body, and we find that they have different sizes due to the intervention of the environment and genetic factors, such as race and gender (9; 10, 11). Climate, illness, and nutrition are examples of environmental variables that may have an impact on developing tooth types but have little effect on a healthy dentistry structure (9). Different populations may have different tooth sizes (13; 14). Hyperodontia, megadontia, microdontia, and accessory teeth are caused by a combination of genetic and environmental factors (12; 18). Men typically have larger teeth than women, which is an example of sex difference, and our research results support these theories.

According to pervious study on dental crown size measurements (6), reported that the mesiodistal and buccolingual crown tooth size can be used to determine sex and proposed that numerous molar teeth could be used for gender dimorphism, which is consistent with our finding that adult Sudanese men have a larger crown size than adult females, and this might be used for sexual dimorphism in Sudanese. Identifying sex from skeletal remains is currently one of the primary problems in osteoarchaeology and forensic anthropology. Dental sexual dimorphism has long been recognized as a reliable biological trait, and research has shown that dental measurements are a reliable way to determine the sex of skeletal remains in various groups (15). One of the few reference studies for sex estimation in Sudanese archaeological groups using odontometric data is the current study.

In the present study, the crown width of the three permanent mandibular molar teeth of adult Sudanese was measured mesiodistally and buccolingually. The mean and standard deviation values of the mesiodistal and buccolingual crown widths was 10.32±1.14 and 9.68±0.78, 10.15±0.96 and 9.34±0.86, 9.73±0.96 and 9.05±0.76 for the first, second and third mandibular molar teeth respectively. This result revealed that crown size decreased gradually from the first to the third molar teeth, and the mesiodistal crown width was larger than the buccolingual crown width for all molar teeth. The adult Sudanese crown sizes of the first and second mandibular molars were slightly smaller than those reported in previous studies in some adult populations. A study conducted by Abd Elhameed M, et al (5) on adult Egyptian population dentition and showed the mesiodistal and buccolingual crown dimension was 10.70±0.43 and 10.19±0.38,

10.32±0.42 and 9.69±0.53 for the first and second mandibular molar teeth respectively. Another study applied on the Iranian permanent dentition and demonstrated that the mesiodistal and buccolingual crown measurements was 10.83±0.72 and 10.75±0.56, 10.30±0.69 and 10.58±0.64 for the first and second mandibular molar teeth respectively (6). A study was done for the first and second mandibular molar teeth in Korean population, demonstrated that the mesiodistal and buccolingual crown widths were 11.58±0.45 and 10.92±0.47, 10.87±0.60 and 10.66±0.54, respectively, for the first and second mandibular molar teeth, while for females, the mesiodistal and buccolingual crown widths were 11.13±0.69 and 10.56±0.53, 10.59±0.72 and 10.45±0.52 for the first and second mandibular molars respectively (7). Another study conducted on Bosnia and Herzegovina dentitions and the mesiodistal and buccolingual crown dimensions for the third molar teeth was 9.70 and 8.63%, respectively (8), indicating that their third molar crown size is slightly smaller than the crown dimensions of the adult Sudanese third molar teeth.

The measurements of adult Sudanese participants' sound mandibular molar teeth that were extracted for this study are legitimately used in technical orthodontic processes, as well as for research and teaching purposes by dental professionals and students. Additionally, the data can be ethically applied to a human tooth bank. According to previous research, sound teeth that were removed were used to create a dental bank along with dentistry professors and students' research and training purposes (16; 17).

5. Conclusion

The findings of this study indicate that there are differences in the crown dimensions of mandibular molar teeth in adult Sudanese. Consequently, the acquired information may be utilized as proof of sex identity in forensic investigations. On the other hand, it may be gained for the purpose of instructing and training dental professionals and students in the technical aspects of orthodontics.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare that they have no affiliations with or involvement in any organization or entity with any financial interest in the subject matter or materials discussed in this manuscript.

Statement of ethical approval

The Institutional Ethics Committee gave its approval to carry out the current suggested community-based study.

Statement of ethical approval

Informed consent was obtained from all individual participants included in the study.

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