Egyptian Journal of Forensic Sciences (2016) 6, 157–164

HOSTED BY

Contents lists available at ScienceDirect

Egyptian Journal of Forensic Sciences

journal homepage: http://www.journals.elsevier.com/egyptian-journal-of-forensic-sciences

ORIGINAL ARTICLE

Sex discrimination by odontometrics in Libyan subjects

Fatma El Sheikhi, Iman Bugaighis *

Faculty of Dentistry, University of Benghazi, P.O. Box 595, Benghazi, Libya

Received 30 May 2015; revised 12 September 2015; accepted 11 November 2015
Available online 28 November 2015

KEYWORDS

Libyan;
Dental;
Forensics;
Schoolchildren

Abstract *Objectives:* To evaluate sexual dimorphism in crown width and cusp parameters of permanent maxillary first and second molars and to use these parameters to derive a new formulae for sex determination in Libyan subjects.

Materials and methods: A sample of 200 upper dental casts of Libyan subjects (100 males, 100 females, aged 12–17 years) were selected from a larger cohort. Eight parameters were determined for each of the left maxillary first (M1) and second (M2) molars using a digital caliper: four crown width measurements (buccolingual, mesiodistal, mesiobuccal–distolingual and distobuccal–mesiolingual) and four cusp measurements (hypocone, protocone, paracone and metacone) were taken. The percentage of sexual dimorphism for each parameter was computed. The accuracy of sex discrimination for each molar individually and both molars combined was determined by discriminant function analysis. A formula for sex determination was generated using the same statistical tool.

Results: The greatest sexual dimorphism was observed in the paracone and protocone for M1, and in metacone and mesiobuccal–distolingual width for M2. The most accurate sex determination was obtained using data of M1 alone, or M1 and M2 combined. Using these data, we were able to generate a formula for sex determination for each M1 and M2.

Conclusion: The formulae derived from this study, is potentially useful in narrowing the search and identifying the sex of Libyan post-mortem records when other means of identification are not feasible.

1. Introduction

Revealing sexual identity is a key factor in the recognition of human skeletal remnants as it lessens the number of potential suspects by half. Sex identification is considered an aid for calculating the age of a subject at death since the following approaches for age and stature assessment are usually sex reliant.[1] It has been reported that in forensics, shape and parameters of the skull and pelvis are the most reliable sources for human sex determination.[2,3] Also, measurements of long bones especially femur and humerus can indicate precisely the sex of the remains.[4] However, in many circumstances the only feasible specimen for sex discrimination are teeth as they can resist taphonomic decay more than other parts of the

* Corresponding author.
E-mail addresses: m_takwa@yahoo.com (F. El Sheikhi), isbugaighis@yahoo.com (I. Bugaighis).

Peer review under responsibility of The International Association of Law and Forensic Sciences (IALFS).

http://dx.doi.org/10.1016/j.ejfs.2015.11.001

skeleton.[5] Thus, odontometric measurements have been widely used in the identification of skeletal remains from a forensic perspective. Several studies reported the utilization of traditional crown measurements (mesiodistal and buccolingual crown parameters) in their odontometric sex discrimination studies.[6–11] Acharya and Mainali[9] noticed that crown length and breadth measurements in Nepalese population provided a sex discrimination accuracy ranging between 68% and 81%. In a similar study, Ates et al.[11] observed comparable rates of precision (68–81%) in Turkish subjects. Lately, Prabhu and Acharya[10] detected regression accuracy of 63–75% for both maxillary and mandibular teeth measurements in the Indian population.

Recently, a number of published researches used the four main maxillary molars cusp parameters (paracone [mesiobuccal], protocone [mesiolingual], metacone [distobuccal], and hypocone [distolingual]) in human biological investigations and sex discrimination research.[3,12] These researchers argued that, investigations relying on the cusp parameter might be more biologically reliable than examining the entire crown dimension. This is because paracone develops prior to hypocone and each of the molar cusps reveals a different growth pattern[13] and independent developmental characteristic[14,15] which might suggest that odontometric features of each molar crown might be revealed by the accumulative outcome of their individual cusp parameters.[16] It has been reported that teeth which develop later are prone to be more variable in size and reveal greater sexual discrepancy because of the increasing difference in hormone secretion.[17] Furthermore, significantly fragmented remains where the mesial and distal tooth surfaces are incapacitated might compromise the accuracy of crown width and breadth measurements. Currently there are no odontometric standards for sex discrimination in Libyan populations. Thus, the aim of the present study was to evaluate sexual dimorphism potential value of permanent maxillary first and second molar crown widths and cusp parameters, furthermore, to compute a new formula for sex determination in Libyan subjects.

2. Materials and methods

The examined sample comprised 200 maxillary casts selected from a random sample obtained from Libyan schoolchildren attending intermediate schools in Benghazi City comprising 19% of the whole Libyan population. Intermediate schools were selected from a list obtained from the Ministry of Education Directorate in Benghazi and were based on five geographic regions; central, Eastern, Western, Northern and Southern. Four schools were selected randomly from each geographic area. The total number of students attending these schools was 43,881 (22,248 females and 21,633 males), a stratified sampling approach was followed in data collection where the number of subjects recruited from each district varies along with the total number of students to ensure fair representation of the targeted population. A list of children in each classroom was obtained; every fifth child was examined to assure randomization. The students who fulfilled the inclusion criteria were requested to participate in the study after informing their parents and obtaining consents. Nine hundred students (453 males and 447 females) aged 12–17 years were examined at the school premises by one examiner (I.B). The participants were of Libyan origin for at least two generations with no craniofacial abnormalities and none had undergone previous orthodontic treatment. All permanent teeth were fully erupted up to the second molars, with no caries or restorations, tooth wear and no micro or macrodontia that might interfere with accurate assessment or precise odontometric information. A total of 343 students (169 males with a mean age of 14.1 years, SD = 1.1 and 174 females with a mean age of 14.4 years, SD = 1.1) fulfilled the reported requirements which was used to conduct other research studies related to malocclusion.[17,18] Further inclusion criteria were added to undertake the present study. Thus, only the teeth with intact and clear morphology of the four principal cusps (protocone, paracone, metacone, and hypocone), clear and distinguishable central pit and marked fissures that separate the cusps were included in the study (Figure 2). Subjects with unclear crown morphology or with obscure main fissures that separate the cusps due to decay, restoration or attrition were excluded from the study. Only 200 subjects (100 males, 12–16 years of age with a mean age of 14.5 years, SD = 1.2 and 100 females, 12–16 years of age with a mean age of 14 years, SD = 1.1) had fulfilled the inclusion criteria.

2.1. Measurements

The mesiodistal (MD), buccolingual (BL), diagonal mesiobuccal–distolingual (MB–DL) and distobuccal–mesiolingual (DB–ML) crown dimensions of the left permanent maxillary first (M1) and second (M2) molars were calculated on each cast (Figure 1) employing a digital caliper (BGS Germany Vernier Caliper 0–150; accuracy 0.01 mm) by one operator (F.E) blinded to the sex of the examined models. The MD parameter was recorded as the greatest measurement between the contact points on the estimated surfaces of the tooth crown. Measurements were extracted with the caliper beaks placed occlusally along the long axis of the tooth. The BL measurement was determined as the maximum distance between the buccal and lingual surfaces of the tooth crown, calculated when the caliper beaks were held at right angles to the MD parameter.[19] The diameter of each cusp was computed by measuring the diagonal distance from the central pit to the most distant point

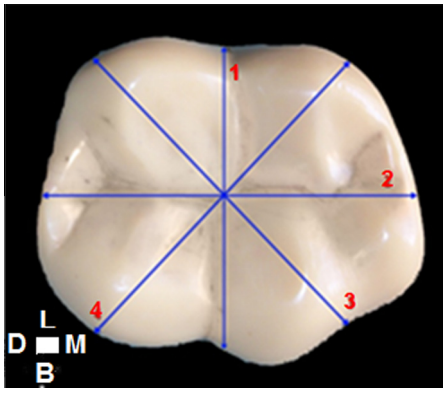

Figure 1 Representation of the extracted measurements; 1-buccolingual width, 2-mesiodistal width, 3-mesiobuccal–distolingual diameter, 4-mesiolingual–distobuccal diameter.