HOMO - Journal of Comparative Human Biology 65 (2014) 322–329

Contents lists available at ScienceDirect

HOMO - Journal of Comparative Human Biology

journal homepage: www.elsevier.com/locate/jchb

Sex determination by tooth size in a sample of Greek population

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ARTICLE INFO

Article history:
Received 14 March 2013
Accepted 28 November 2013

ABSTRACT

Sex assessment from tooth measurements can be of major importance for forensic and bioarchaeological investigations, especially when only teeth or jaws are available. The purpose of this study is to assess the reliability and applicability of establishing sex identity in a sample of Greek population using the discriminant function proposed by Rösing et al. (1995).

The study comprised of 172 dental casts derived from two private orthodontic clinics in Athens. The individuals were randomly selected and all had clear medical history. The mesiodistal crown diameters of all the teeth were measured apart from those of the 3rd molars. The values quoted for the sample to which the discriminant function was first applied were similar to those obtained for the Greek sample. The results of the preliminary statistical analysis did not support the use of the specific discriminant function for a reliable determination of sex by means of the mesiodistal diameter of the teeth. However, there was considerable variation between different populations and this might explain the reason for lack of discriminating power of the specific function in the Greek population. In order to investigate whether a better discriminant function could be obtained using the Greek data, separate discriminant function analysis was performed on the same teeth and a different equation emerged without, however, any real improvement in the

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http://dx.doi.org/10.1016/j.jchb.2014.05.002
0018-442X/

classification process, with an overall correct classification of 72%. The results showed that there were a considerably higher percentage of females correctly classified than males.
The results lead to the conclusion that the use of the mesiodistal diameter of teeth is not as a reliable method as one would have expected for determining sex of human remains from a forensic context. Therefore, this method could be used only in combination with other identification approaches.

Introduction

Odontological examinations are crucial in forensic identification, especially in cases of severely damaged or decomposing bodies (Pereira et al., 2010). Although teeth are such small structures, they keep a secret "treasure" of forensic data.

While crime rates are increasing in the recent decades and mass disasters are more common, there is a vast need for an evaluation of sex, ancestry, and age from human remains in order to reconstruct a biological profile which can be compared to missing persons (Cunha et al., 2009).

Sex determination of skeletal remains has great importance in bioarchaeological and forensic investigations (Acharya and Mainali, 2008). The applied methods vary and depend on the availability and the condition of the recovered material. Anthropological measurements of various parts of the skeleton are based on the comparison with existing data (Acharya and Mainali, 2008; Asala, 2002; Lund and Mornstad, 1999; Muller et al., 2001; Olayinka et al., 1996; Owsley and Webb, 1983; Patriquin et al., 2002; Pettenati-Soubayroux et al., 2002; Rösing et al., 1995; Yeun et al., 1997). In forensic cases to reach the 100% accuracy of sex determination is of major importance although, in most cases, the sex is not clearly distinguished, but the determination is based on strong indications (Acharya and Mainali, 2008; Asala, 2002; Muller et al., 2001; Owsley and Webb, 1983; Rösing et al., 1995).

In cases concerning young individuals the use of teeth in sex determination appear very helpful because the secondary sexual characteristics have not yet developed. The same applies to cases where only teeth or jaws are preserved (Acharya and Mainali, 2008; Lund and Mornstad, 1999; Owsley and Webb, 1983; Rösing et al., 1995). Odontometry can prove very valuable to mass casualty incidents when the recognition of the bodies is impossible by other means (Muller et al., 2001). However, it has been indicated to use the odontometry in combination with the assessment of other data from the skull (Rösing et al., 1995).

It was in 1938 that Buthz and Erhrhardt stated that the human dental sexual dimorphism could be estimated by odontometric methods (Buthz and Erhrhardt, 1938). The conclusion of their study was that the variation of crown sizes does not allow a clear differentiation between sexes. Later, in 1953, Brabant and his co-workers established the influence of sex on the production of dental lamina (Brabant et al., 1953). In 1963, Schrantz and Bartha proposed seven dental morphological types that could be used for sex determination (Schrantz and Bartha, 1963). In addition, Aitchison (1964) presented nine dental and cranial characters in order to evaluate sexual dimorphism.

Therefore, it has been assessed that teeth present sexual dimorphism, in crown diameters of the deciduous and permanent dentition, at a statistically significant level, as it has been proven by various odontometric and discriminant analyses. Sexual dimorphism is observed in all tooth types (Acharya and Mainali, 2008; De Vito and Saunders, 1990). The expression of sexual dimorphism is lesser in the deciduous than in the permanent dentition. In general, it has been proven that males have larger teeth than females (Acharya and Mainali, 2008; De Vito and Saunders, 1990; Yeun et al., 1997; Zorba et al., 2011).

Various methods have been applied in an attempt to determine sex using odontometric data. Combinations of root lengths and crown diameters present a high discriminatory possibility (Acharya and Mainali, 2008; De Vito and Saunders, 1990).