Sexual dimorphism of the maxillary postcanine dentition: A geometric morphometric analysis

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Abstract: The aim of this work was to study the sexual dimorphism of the occlusal surface of the maxillary postcanine dentition using geometric morphometric techniques. This study evaluated 139 individuals as part of five osteological collections from municipal cemeteries in the province of Granada (Spain). The landmarks and semilandmarks were analysed by principal components analysis, canonical variate analysis and discriminant analysis. Only the fourth maxillary premolar showed significant sexual dimorphism; however, cross-validation values for shape variables were 64.44% for males and 63.60% for females and 60.17% for males and 60.99% for females when both shape and size variables were considered. The third maxillary premolar and first and second maxillary molars did not show significant sexual dimorphism. The results show that maxillary postcanine dentition cannot assist in sex estimation, either only shape or shape and size.

Keywords: sex estimation; premolar; molar; landmarks; semilandmarks; cross-validation

Introduction

Sexual dimorphism has been of great interest in the scientific literature due to its use in the analysis of differences between individuals of female and male biological sex (İşcan 2005). Sexual dimorphism is defined as the difference between males and females of the same species in terms of body size, body shape, time of development or behaviour (Moore 2013), as a combined result of genetic and environmental factors (Stinson 2012). In humans, the primary sexual characteristics of the genitals begin to differentiate in early stages in the uterus (Bogin 1999), while the secondary ones begin to develop at puberty (Wells 2007). This expression of secondary characteristics in the skeleton makes the estimation of sex a simpler task in adults than in children. Although the techniques most used in the evaluation of sex in the human skeleton have focused mainly on the pelvis and the skull (Dawson et al. 2011) along with the long bones (Spradley &

Jantz 2011), there are numerous studies that have identified dimorphic characteristics in human dentition (Moorrees et al. 1957; Garn et al. 1964; Garn et al. 1966; Hattab et al. 1996; Acharya & Mainali 2007; Ling & Wong 2007; Vodanović et al. 2007; Cardoso 2008; Zorba et al. 2011; Viciano et al. 2013; Viciano et al. 2015).

These differences in the dentition of males and females can be explained by the differential effect of the X and Y chromosomes on dental growth, especially in the growth of the dental lamina (Alvesalo 1997; Alvesalo 2013). While the Y chromosome promotes the growth of both enamel and dentin, the X chromosome is restricted to enamel growth (Alvesalo 1997); in this way, the differences between the sexes are translated into the thickness of the dentin-pulp complex and enamel (Harris & Hicks 1998; Zilberman et al. 2000).

These effects lead to different expressions in the human dentition based on sex that have been mostly studied not