Estimation of ancestry for an undocumented mandibular sample using dental morphology

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With 3 figures and 7 tables

Abstract: Dental morphology is a useful resource in archaeology, anthropology and paleontology, due to its genetic determination. Teeth are a material of high durability and stability. This work aims to study the dental morphology and test the Portuguese and European biological affinities of an undocumented mandibular sample, through comparison with global and Iberian samples. The dental traits in 163 mandibles (kept at the Museum of Natural History of the University of Oporto, Portugal) were scored using a standardized methodology (ASUDAS: Arizona State University Dental Anthropology System) and compared to other world-wide and Iberian samples through Principal Components (PCA) and Mean Measure of Divergence analyses.

The undertaken quantitative and statistical tests demonstrated the unknown sample to be closer to the Coimbra Portuguese sample in all three comparisons. This suggests this undocumented mandibular sample is possibly of Portuguese 19th/20th century origin.

Keywords: ancestry estimation; sample of unknown origin; dental morphology; principal components analysis (PCA); mean measure of divergence (MMD)

Introduction

Human dental morphology is comprised of a set of discrete variables highly dependent on genetics (Scott & Turner 1997). These traits are determined by a relatively small and stable part of the human genome (Tyrrell 2000). They are generally independent of environmental disruption, of the sex of an individual or of evolutionary pressures. Dental traits are also generally uncorrelated (Tyrrell 2000). Because of this, nonmetric dental characters are considered genetically more reliable than cranial and postcranial discrete traits (Alt & Vach 1998; Silva 2002). However, genetic and environmental factors are not entirely independent and epigenetic processes impacting development also influence phenotype (Jernvall et al. 2000; Townsend et al. 2009; Townsend et al. 2012; Hughes & Townsend 2013). The usefulness of dental morphology in detecting the extent of biological relations among human groups has been shown, with application to global, regional and local groups (Scott & Turner 1997). Teeth are the most durable part of the human organism, and are resistant to most diagenetic pressures (Avon 2004; Hillson 2005; Irish & Nelson 2008; Scott & Turner 1988; Scott 2008; Silva 2002) which, adding to the other cited advantages, make them an important source of information in bioarchaeology, biological anthropology and human evolution (Scott 2008). Dental morphology has contributed to population genetics studies of migration, genetic drift and gene flow and supplies valuable and comparable data at a reduced financial cost (Irish 2000; Rodriguez Floréz 2004; Silva 2002; Ullinger et al. 2005).

Dental nonmetric traits are sometimes used in determining ancestry (essential in forensic profiling: Simmons & Haglelund 2005), mainly Carabelli’s trait, shovel shaped incisors, lower premolar lingual cusp number, canine mesial ridge and cusp 7 (Edgar 2009; King 2010; Pretty & Sweet 2001; Schmidt 2008; Ubelaker 2008). The usefulness of dental metric traits in estimating ancestry has also been documented (for example: Chiu & Donlon 2000).