Dental nonmetric trait intraobserver precision: three observations of a large sample

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With 2 tables

Abstract: The utility of nonmetric dental traits in population phenetic studies is well documented. However, consistency in scoring trait expression is a concern due to the subjectivity in scoring quasicontinuous variables with graded scales. The aims of this study are to 1) analyze intraobserver results from an independent scorer and 2) interpret the least precise results. Six hundred individuals (300 of each sex) were scored for 48 dental nonmetric traits using ASUDAS, in one preliminary (100 individuals) and two full observations. Intraobserver precision between scoring sessions yielded adequate results (85% to 100%), with two notable exceptions (UI2 tuberculum dentale and LC distal accessory ridge) and three somewhat problematic cases (UM2 hypocone, UM1 Carabelli’s trait, and LM1 anterior fovea). Kendall’s τ-b rank correlation coefficients are usually moderate to strong (> 0.3). The results are similar to previously published studies of observer error. Error rates are likely caused by inexperience in observable surface selection and trait/grade definition. ASUDAS requires restraint from scoring teeth that are too worn or modified by caries or chipping. A careful study of trait and grade definitions is strongly encouraged. The key element in achieving high precision rates is experience. Intraobserver (and, if needed, interobserver) error should always be calculated. Overall, ASUDAS is a reliable and useful method, especially if the author’s recommendations are followed.

Keywords: Dental anthropology; measurement error; Arizona State University Dental Anthropology System; concordance in classifying dental morphology

Introduction

Dental morphological variation is found within and between populations, which indicates that variation is largely due to genetic drift, founder effect and gene flow (Willermet & Edgar 2009; however, see Mizoguchi 2013), despite the undeniable role of environmental effects on odontogenic processes (Salazar-Ciudad & Jernvall 2002; Sperber 2004; Salazar-Ciudad & Jernvall 2010; Hughes & Townsend 2013). Since nonmetric dental traits are genetically transmitted to a relatively high degree, they are ideal for the study of the biological relations between past populations (Nichol 1989; Scott & Turner 1997; Tyrrell 2000; Rizk et al. 2008). The ability to draw valid conclusions regarding population phenetic variation from discrete dental variables depends on the reliability of data, which should be collected as accurately as possible.

Reproducibility of a method is an important concern for researchers (Nichol & Turner 1986; Scott & Turner 1997). However, inconsistency is a part of every measurement, either caused by the method or the observer (Harris & Smith 2009). The Arizona State University Dental Anthropology System (ASUDAS) (Turner et al. 1991) is no exception. The division of quasicontinuous nonmetric dental traits into grades, a characteristic of ASUDAS, makes subjectivity an inherent part of the method (Scott & Turner 1997; Hillson 2005). Acknowledging experience as relevant, applying clear definitions, and exploring scoring errors diminish this subjectivity (Scott & Turner 1997; Hillson 2005). Intra- and interobserver errors have been calculated in previous studies, achieving precision rates from 85% to 100% in dichotomized data (divided into presence-absence) (Scott 1977; Nichol & Turner 1986; Scott & Turner 1997). Yet, these error calculations are dependent on the observers, the chosen traits and the conditions of each observation, and therefore should be determined by each researcher (Hillson 1996).

The intraobserver precision and correlation results displayed below are calculated from observations on a large sample from the University of Coimbra. The present article aims to 1) discuss the intraobserver results of ASUDAS,