



Physical Anthropology Section – 2006

H14 An Assessment of Non-Metric Traits of the Mandible Used in the Determination of Ancestry

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The goal of the current study is to present results of the analysis of non-metric traits of the mandible used in the determination of ancestry and to demonstrate the utility of ordinal regression in the examination of discrete skeletal characteristics.

This study is the first multivariate study conducted on discrete mandibular traits used for the determination of ancestry. Employing ordinal regression on a large sample of identified individuals, this study determines whether sex and age affect the incidence of each trait independently of ancestry. Additionally individuals from two separate continents are examined; therefore, the findings are applicable for worldwide use. While ancestry determination from the cranium has been established as reliable in the literature, a suite of characteristics derived from multiple bones is preferred. This presentation will impact the forensic community and/or humanity by demonstrating how the inclusion of mandibular traits builds on previous non-metric studies and helps to increase the reliability of ancestral determination from the skeleton.

In the field of forensic anthropology, the construction of a biological profile is of utmost importance in the identification of a decedent. The biological profile includes the age, sex, stature, and ancestry of the individual. Of these, ancestry is considered the most difficult and least precise.

The purpose of this study is to build on previous non-metric studies of the mandible to determine whether it may be used to differentiate between individuals of European and African ancestry. Several studies have shown that ancestry can be determined by looking at non-metric characteristics of the cranium. Unfortunately, few of these studies have included the mandible. Many relevant studies suffer from small sample sizes, did not control for age or sex, or were derived from collections whose ancestry was anatomically determined rather than known. Many of the traits commonly used for the determination of ancestry are found on the face. However, these facial bones are rather thin, are the most fragile part of the skull, and are usually the first to be destroyed by taphonomic forces. The mandible, however, is quite dense and is better able to survive in an archeological or forensic setting. This study looked at skeletal remains from the HamannTodd Collection, the Terry Collection, a forensic collection at the University of Florida, and the Pretoria Bone Collection in South Africa. A large sample of modern individuals ($n = 921$) from two continents is used, all having documented age, sex, and ancestry. Twelve non-metric traits were examined: ramus inversion, location of inversion, gonial eversion, mandibular border form, mandibular tori, robusticity of muscle attachment sites, mylohyoid bridging, accessory mandibular foramen, chin prominence, chin shape, number of mental foramina, and the position of the mental foramen. Europeans and Africans were analyzed to determine how traits differed from one broad ancestral group to the other. Additionally, the smaller subgroups were compared (e.g. European American vs. European African) to see if there was any difference in trait expression between the more closely related groups.

Wilcoxon Signed Ranks Test was used to determine if there was a relationship between trait frequency and side. This test was also used to see if there was a significant amount of intra-observer error between the first and second scorings of the Florida sample. Ordinal regression was utilized to determine the effect, if any, that age, sex, ancestry, and the interaction between sex and ancestry have on any given non-metric trait.

Six traits differed significantly between the left and right sides. Intraobserver error was relatively low, with two traits showing a significant difference between the first and second observations. Nine out of 12 traits were significantly affected by ancestry. However, due to the effects of sex, age, and the sensitivity of ordinal regression, some of these traits may be less useful than others in determining ancestry in unknown cases. Ramus inversion, gonial inversion, muscle attachment sites, chin shape, number of mental foramina, and position of the mental foramen are the most effective traits to use when determining ancestry. However, caution must be taken because all of them except the number of mental foramen are significantly affected by sex. The number of mental foramina may be the most reliable trait because it is statistically and practically significant and it is not affected by sex, age, or the interaction between sex and ancestry. However, multiple foramina are very rare in each population studied.

European individuals were found to most likely possess little to no ramus inversion, no gonial eversion (straight gonia), gracile muscle attachment sites, a round or square chin, one mental foramen, and a more anteriorly placed mental foramen. Individuals of African descent were more likely to display moderate to extreme ramus inversion, gonial inversion, a round chin, and multiple mental foramina.

Ancestry, Non-Metric Traits, Mandible