ABSTRACT

Sexual dimorphism is one of four critical factors assessed by forensic anthropologists when compiling biological profiles. The current study used geometric morphometric methods to analyse various aspects of sexual dimorphism in white South African crania to significantly contribute to current forensic standards for this underrepresented population.

As edentulous crania are a major contributing factor to the low number of publications on white South African populations, the question arose as to how tooth loss affects cranial structures and the accuracy of sex and ancestry estimation. Two hundred and twenty nine crania were digitised using landmarks and sliding semilandmarks, both globally and for a number of cranial subsets. Although a number of effects were identified when the skull was analysed globally, only the maxillary alveolar ridges were significantly affected when subsets were analysed individually. As both upper facial height and palate shape were significantly altered by tooth loss, the effects of tooth loss on cranial structures and sex and ancestry estimations were investigated.

Next, to parse out the mechanisms by which sexual dimorphism causes morphological variation, overall sexual dimorphism, common allometry and non-allometric sexual dimorphism were individually assessed. Global and subset data were studied and the effects of sexual dimorphism and allometry were found to be universal, with significant differences being observed between the sexes both globally and regionally. A significant non-allometric component was, however, only found to contribute to the shape of the zygomatic bone.

Finally, the accuracy of 17 widely used traditional cranial measurements was compared to all possible interlandmark distances (ILDs) attainable from 45 fixed landmarks. Discriminant functions derived using the ILDs compared well to those of previous work on white South Africans, thus demonstrating the similarity between traditional and 3-D methods. Finally, custom discriminant functions were created for a number of cranial subsets and for the cranium in its entirety. The subsets achieved sexing accuracies ranging between 71.8% and 83.7%, with the nasomaxilla proving most accurate. The overall cranial function attained a cross-validated sexing accuracy of 88.2%. These functions are critical for sex estimation not only for intact crania, but also for the innumerable fragmentary cranial remains recovered regularly in South Africa.