

THE APPLICATION OF THREE-DIMENSIONAL MIDFACIAL PROFILING IN THE IDENTIFICATION OF HUMAN SKELETAL REMAINS

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Forensic DNA analysis is increasingly being used for the identification of human skeletal remains in cases of mass fatality, war, and genocide. However, this work is often expensive and time consuming, and the results can be inconclusive without independent corroborating evidence. In situations where the relationship between large groups of individuals is unclear, forensic genetic analyses can be greatly aided by identifying ancestral subgroupings based on skeletal morphology.

Studies using traditional anthropometric techniques have identified morphological variation in the midfacial region as especially useful as a source of information for assessing the ancestral affinities of people whose skeletal remains are found in forensic contexts. Multivariate discriminant functions derived from measurements of this area have been shown to perform fairly well in the identification of people with recent European, African, and Asian ancestral affinities. Quantifying subtle differences in facial form requires specialized anthropometric instruments, such as subtense calipers and craniophores. Even with these tools, the landmark-based approach of traditional craniometric analyses captures only a limited amount of information about facial form.

In this study, we demonstrate a new method for quantifying shape variation in the midfacial region of human crania using three-dimensional laser scan data. Digital, three-dimensional models of the crania of people of Native American and European ancestry were sectioned along the plane passing through nasion and the most inferior points on the right and left sides of the zygomaxillary suture (zygomaxillare). The shapes of these midfacial profiles were analyzed using Elliptical Fourier Analysis (EFA). The coefficients of the resultant equations were then used to develop discriminant functions for classifying individuals according to their ancestral population. Our results indicate that this new technique provides much more useful information on population differences in facial morphology than conventional craniometric techniques. This study shows that three-dimensional midfacial profiling has great potential for assisting in the identification of human remains and in the development of investigative leads in cases of missing persons and violent crimes.