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Population Affinities of 19th Century Cuban Crania: Implications for Identification Criteria in South Florida Cuban Americans*

ABSTRACT: Identification criteria, specifically discriminant function formulae derived from traditional craniometrics, currently used in South Florida for Cuban Americans and other "Hispanic" groups, are unsuitable to provide adequate biological profiles due to complex biological histories as well as widely diverse geographic origins. Florida's total population is approximately 16 million (15,982,378) individuals. Of the total population 2,682,715, or 16.8%, are self-identified as "Hispanic". South Florida (herein defined as Miami-Dade, Broward and Collier Counties) is home to 60% of the total Hispanic population of Florida with 1,291,737 (48.15%) residing in Miami-Dade County.

The Hispanic population of Miami-Dade County makes up 57.0% of the total population of 2,253,362. Each recognized sub-group of Hispanics (Mexican, Puerto Rican, and Cuban) includes its own geographic point-of-origin and population history. Cuban-Americans (arriving in the late 1950's and early 1960's) make up the largest sub-population of Florida's Hispanics in any county and in Miami-Dade number 650,601 or 51% of the total Latin population. Additionally, as in other agricultural states, Florida has a very large population of undocumented workers who primarily arrive from Texas and points south of the Straits of Florida.

Thus the application of the available traditional craniometric and non-metric methods are not appropriate for South Florida's Latin population. To begin to address this issue in relation to South Florida's Cuban population, we present an analysis of cranio-facial shape variation in a 19th Century Cuban sample, 17th Century Spanish sample, a Precontact Cuban sample, and Terry Blacks using geometric morphometric methods. Significant biological shape differences and patterns of variation are observed among the groups. These results provide us with a context in which to begin to understand the biological variation of Cuban Americans, which will enable the development of identification criteria specific for this U.S. hybrid Hispanic community.

KEYWORDS: forensic science, identification methods, 3-D coordinate data, Hispanic populations, geometric morphometrics

The conquest of the New World was part of fifteenth-century European expansionism. After the conquest, the ethnic composition of the region was drastically changed because of the indigenous populations being decimated by disease and the influx of European and African populations. Colonial Latin America was a highly stratified society. The *peninsulares*, or whites born in Spain, held the highest status, followed by the *criollos*, whites born in the New World. The *mestizos*, *mulattoes* or mixed bloods, Indians and Africans, held the lowest rank. The effects of the colonial stratification are still marked and apparent within Latin America's rigid social classes (1).

The inflexibility of Hispanic social classes is rooted in Medieval Catholicism, which rationalized a class system because each group was "necessary" to perform certain tasks (2). This social segregation and separation of the different communities have resulted in a continued social and political polarization that can be observed in the biological composition of Latin America (3).

After the 1959 Cuban revolution approximately 200,000 refugees made their way to Miami. These early immigrants were primarily businessmen and political refugees. A second wave of approximately 125,000 migrants, commonly known as the Mariel Boatlift or Marielitos, came in 1980 (4). Unlike the first wave of migrants, many of these were comprised of common prisoners and people with mental disabilities and of lower socioeconomic status. Today, according to the U.S. Census, South Florida Cubans make up 66% of the total population of Miami and 90% of the total population of the city of Hialeah located NW of Miami.

In the U.S., the term "Hispanic" includes all persons of Spanish speaking countries. However, in the forensic setting, the use of such an umbrella term is problematic because it ignores the distinct ethnohistories and migration patterns of each geographical region. The use of "Hispanic" as a classification or category does not provide an adequate biological profile.

In this paper, we present a pilot study of the among-sample morphological variation of modern 19th Century Cubans, Precontact Cubans, 17th Century Spanish and Terry Blacks using landmark-based Procrustes analysis from geometric morphometrics. This study provides a background to aid in the understanding of the biological variation of Cuban Americans and will facilitate the development of identification criteria specific for this U.S. hybrid Hispanic community.

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TABLE 1—*Materials used in present study.*

Sample Name	*N*	Source of Data	Provenience
19th Century Cubans	23	Present study	Cemetery collection from Museo de Montane, Havana, Cuba
16th /17th Century Spanish	30	Present study	Collection from Wamba, near the towns of Villanubla and Valladolid in northwestern Spain, Departamento de Biologia Animal, Universidad Complutense, Madrid
Precontact Cubans	6	Present study	Ciboney culture, pre-ceramic archaic, Museo de Montane, Havana, Cuba
Terry Blacks	18	3-D coordinates provided by Daniel Wescott	St. Louis Missouri, currently housed at the Smithsonian Institution

TABLE 2—*List of landmarks used.*

1. Alare left
2. Alare right
3. Asterion left
4. Asterion right
5. Basion
6. Bregma
7. Dacryon left
8. Dacryon right
9. Ectoconchion left
10. Ectoconchion right
11. Eurion left
12. Eurion right
13. Glabella
14. Nasion
15. Inferior orbital border left
16. Superior orbital border left
17. Opisthocranion
18. Opisthion
19. Subspinale
20. Zygomaxillare left
21. Zygomaxillare right
22. Zygoorbitale left
23. Zygoorbitale right

Methods

Four samples totaling 77 individuals were used in the present study. Males and females were pooled in order to incorporate all of the observed biological variation within a population. Population names, sample sizes and proveniences are presented in Table 1.

Twenty-three homologous craniofacial landmarks were selected to reflect the among-group variation (Table 2). The landmarks used in this study are standard craniometric landmarks and detailed descriptions are found in Howells (5). A Microscribe 3-DX® digitizer was used to obtain the x, y, and z coordinates for each landmark using the software 3-dgetcoords, written by Stephen D. Ousley. In addition, mean substitution for dacryon was performed in the Precontact Cuban sample to address possible postmortem deformation in some individuals.

Statistics

Geometric Morphometrics

After digitizing the sets of landmark coordinates, it was necessary to scale, translate, and rotate each configuration of points so that all skulls would be of comparable size, location, and orientation. A Generalized Procrustes Analysis (or GPA) was used to perform these transformations to minimize the sum of squared distances between homologous landmarks on all skulls and scale specimens to a common size (6–8). The GPA superimposition was performed using Morpheus et al., a cross-platform program written by Dennis E. Slice and available for downloading from the SUNY-Stony Brook Morphometrics homepage (9). Briefly, GPA brings the individual forms into a common coordinate system by fitting them to a reference or iteratively computed mean configuration (7). First, a specimen is arbitrarily selected as the initial estimate of the mean form and scaled to have a standard size and translated to be centered at the origin. Next, all forms are brought into a common coordinate system by scaling, translating, and rotating the forms to this estimated mean configuration. Scaling each specimen to unit centroid size (the square root of the sum of squared distances of each landmark to their centroid) establishes a common size for all specimens. Rotation and translation parameters are computed to minimize the sum of squared differences between corresponding points on the forms and the estimated mean configuration. By calculating the average of each coordinate for each landmark across the entire sample, a new consensus estimate is obtained. The change in the sum of squared differences between the individual configurations and the newly estimated mean form is computed. If the change is small enough the procedure will cease. However, if the difference is sizeable the process will return to the scaling, translating, and rotating steps and a new consensus configuration is calculated. In general, the process iterates several times before converging (7–9).

Multivariate Statistics

A principal component analysis (PCA) of the covariance matrix was conducted on the GPA transformed coordinates to reduce dimensionality for subsequent multivariate analyses. A multivariate analysis of variance (MANOVA) was performed on the first four principal component scores to test for mean shape differences between groups. The degree of differentiation was assessed using Mahalanobis D^2 or squared generalized distance of the principal component scores. In addition, an UPGMA Clustering analysis was performed from the generalized distance matrix to characterize relative shape similarities between the groups (10). These analyses were performed using the SAS system for Windows Version 8 (11).

Results

The MANOVA procedure detected significant group differences (Wilks' $\Lambda = 0.189$; F value $= 13.53$; df $= 12$; $p < .0001$). The first four principal components account for 36%, 16%, 12%, and 6%, explaining roughly 69% of the total variation. Mahalanobis D^2 distances based on the first four principal components scores are presented in Table 3.

TABLE 3—*Mahalanobis D^2.*

Group	Terry Black	Modern Cuban	Precontact	Spanish
Terry Black	0			
Modern Cuban	0.796*	0		
Precontact	27.389	34.270	0	
Spanish	2.091	2.351	41.917	0

* Not significantly different. All other distances are significant > 0.001.

Figure 1 shows an anterior view of the superimposition of the mean configurations for modern Cubans (dark spheres), Precontact Cubans (medium dark spheres), Spanish (medium light spheres), Terry Blacks (light spheres) and the grand mean, the mean or average configuration for all groups (shown with connecting links to better orient the reader). This overlay illustrates that Precontact Cubans are morphologically very different from the non-indigenous groups. The superior orbital border is more superiorly and slightly more laterally placed, dacryon is more medially positioned and eurions are more inferiorly oriented in modern Cubans.

Figure 2 is the lateral view of the same overlay and illustrates that basion and opisthion are more inferiorly placed in modern Cubans, while the orientation of basion and opisthion is completely distinct in Precontact Cuban crania from all the modern series. Bregma is more posterior and opisthocranion is more superior in modern Cubans than the Spanish series. This is also clearly illustrated in Fig. 3, which presents the difference between the Modern Cuban mean configuration and the Spanish mean configuration as magnified (X2) difference vectors. The difference vectors show the direction and magnitude of the difference between one form and another. The lateral view displays the antero-inferior location of basion and opisthion, the posterior placement of bregma and

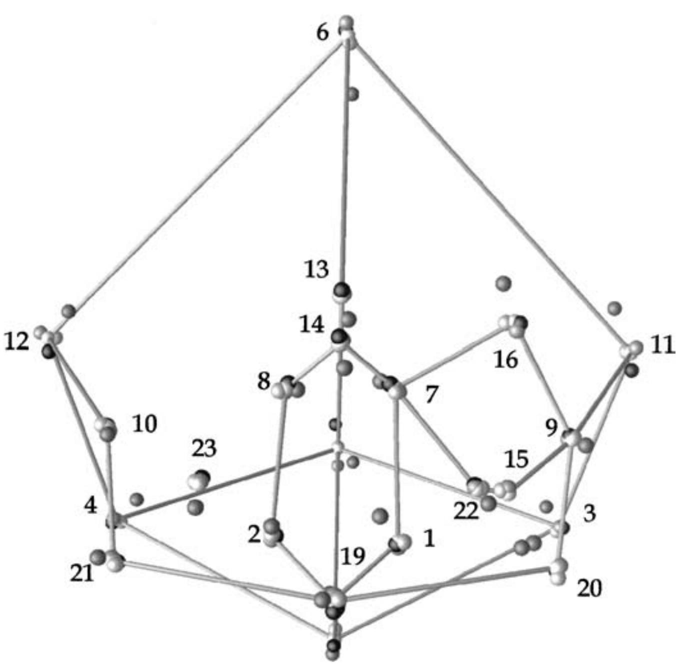

FIG. 1—*Mean landmark locations after GPA of modern Cubans (dark gray), Precontact Cubans (medium dark gray), Spanish (medium light gray), and Terry Blacks (light gray). Lines connect grand mean locations. See Table 2 for landmark identification.*

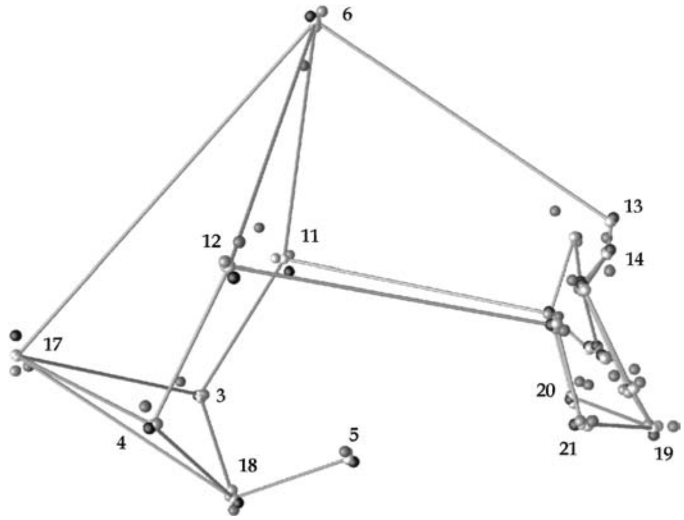

FIG. 2—*Lateral view of data in Fig. 4. See Table 2 for landmark identification.*

asterions, superior location of opisthocranion, infero-medial location of eurion. The anterior view (Fig. 4) illustrates the infero-medial location of zygomaxillare, supero-lateral location of the superior orbital border and ectochonchion, supero-medial placement of dacryon, and the inferior position of subspinale in modern Cubans relative to the Spanish crania. Figure 5 shows the difference between the modern Cuban mean and the black mean. Modern Cubans have a lateraly placed superior orbital border, supero-medial dacryons, superiorly placed nasion, zygomaxillare, bregma, and glabella, inferiorly oriented subspinale, and more medial alares. Eurions are more infero-laterally orientated in modern Cubans than Terry Blacks. The magnitude of the morphological differences is most pronounced between modern and Precontact Cubans as observed in the length of the difference vectors (Fig. 6). Some of the extreme difference between the modern and Ciboney could be due to the effects of a small sample size and perhaps some postmortem deformation. Unfortunately, the only other Precontact sample available (Taino), is characterized by artificial deformation. These issues will be subject to future work.

In the UPGMA clustering analysis (Fig. 7), modern Cuban, Terry Black crania, and Spanish cluster together. Modern Cubans are more similar to blacks and then to the Spanish series and further removed from indigenous Cubans.

Conclusions

For this investigation, landmarks were selected that would reveal the overall craniofacial morphology of the crania.

Notably, modern Cubans show a strong African morphological affinity followed by a Spanish component. This is not surprising given the settlement history of Cuba dating back to the Spanish conquest. More surprising, however, is the dissimilarity to Precontact Cubans reflecting a dissimilar ancestry. We can further conclude that modern Cubans have little or no indigenous Amerindian biological affinity unlike modern Mexicans, which have a strong Amerindian biological element (12). In addition, Mexican and Cuban crania should differ in that Mexican crania lack the African affinity. These results are particularly important for forensic anthropologists where the ultimate goal is human skeletal identification. The results of

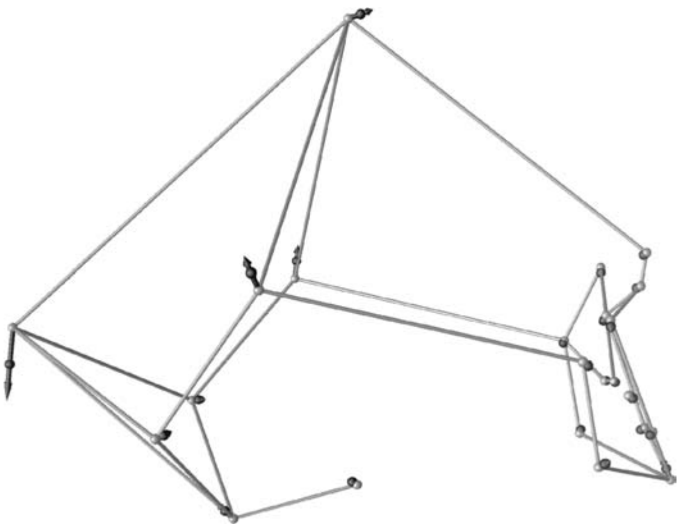

FIG. 3—*Mean landmark differences shown as vectors from modern Cubans (light gray) to Spanish crania (dark gray). Vectors magnified X2.*

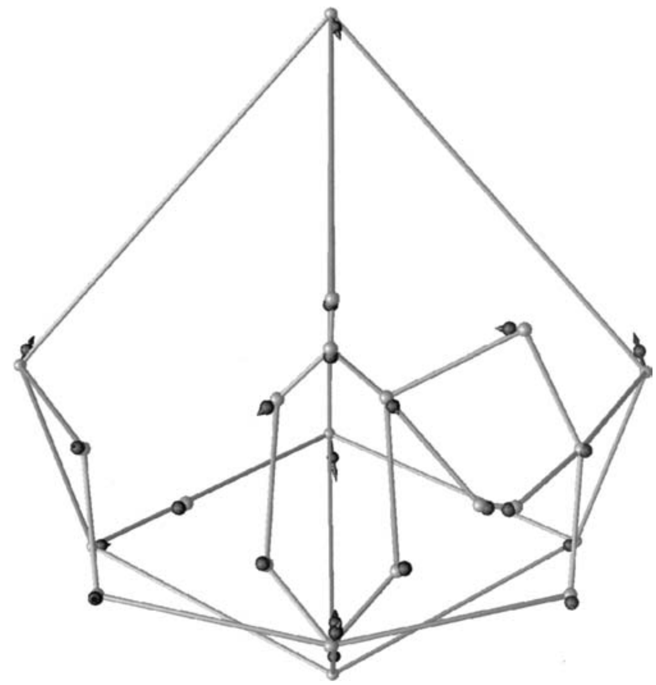

FIG. 5—*Mean landmark differences shown as vectors from modern Cubans (light gray) to Terry Black crania (dark gray). Vectors magnified X2.*

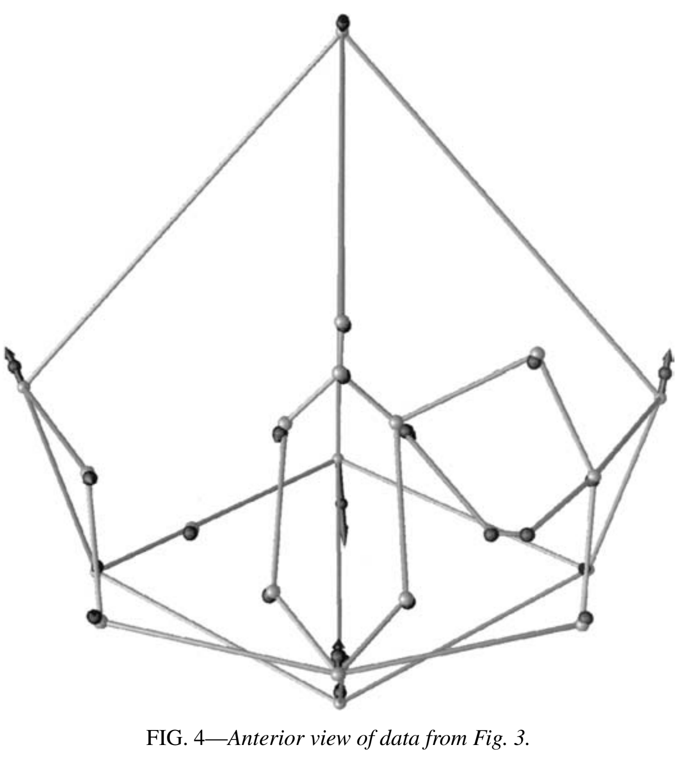

FIG. 4—*Anterior view of data from Fig. 3.*

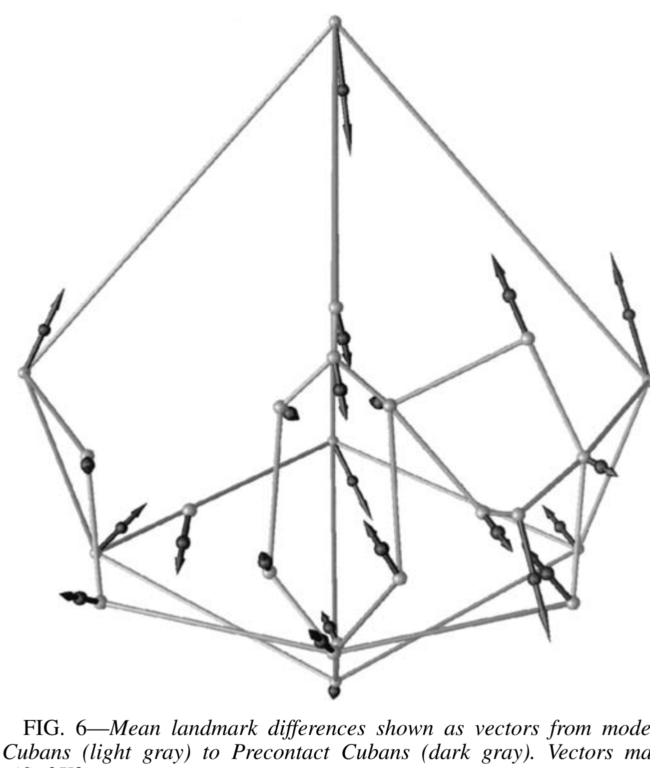

FIG. 6—*Mean landmark differences shown as vectors from modern Cubans (light gray) to Precontact Cubans (dark gray). Vectors magnified X2.*

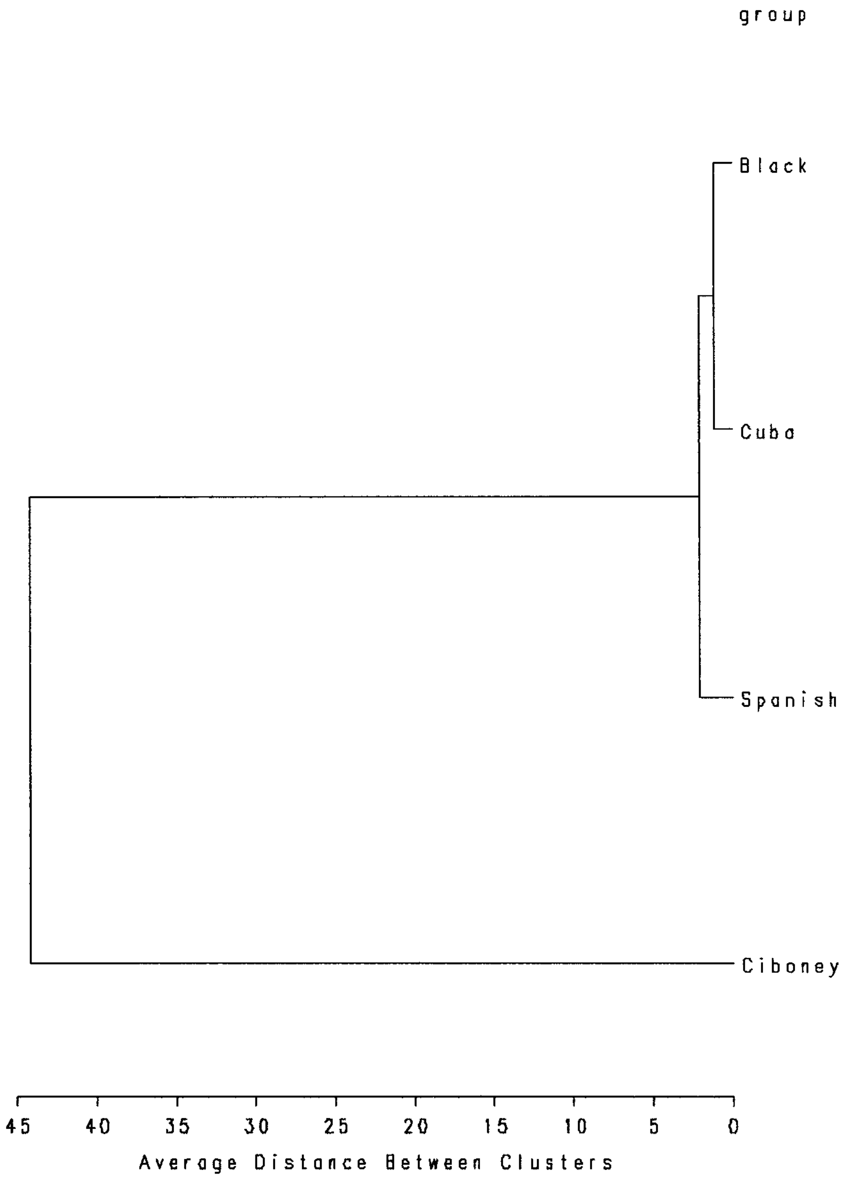

FIG. 7—*Phenogram derived from UPGMA clustering of all groups.*

this study demonstrate that the use of an umbrella term such as "Hispanic" does not afford an adequate biological profile for Cuban Americans or for other Hispanic populations and emphasizes the necessity for investigating regional or geographic morphological variation in "Hispanic" populations and deriving population specific identification criteria.

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