A13 Use of Measurements Derived From Computed Tomography (CT) Head Scans of Modern Americans for Comparison to the Forensic Data Bank of FORDISC® 3.0

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After attending this presentation, attendees will understand how a diverse, modern American population of Computed Tomography (CT) head scans compares to the Forensic Data Bank (FDB). Attendees will also learn about some of the issues encountered when attempting to collect traditional craniometrics from CT scans of living individuals, which tend to be at a lower scan resolution than those collected from cadavers or dry skulls.

This presentation will impact the forensic science community by demonstrating the applicability of CT data in multivariate analyses such as those in FORDISC®. The results suggest that clinical CT scans may be a valuable source of additional population data to enhance anthropological analyses; however, further research is needed to explore how best to replicate traditional craniometrics in clinical CT scans where certain landmarks are typically difficult to locate.

This study presents the first comprehensive population comparison of CT scans of living individuals (n=291) to the FDB of FORDISC® 3.0. Landmarks were placed on rendered 3D models of the skulls of both sexes and three self-identified ancestry groups (African, Asian, and European) using Mimics® software in an attempt to replicate traditional cranial measurements. Triplicate placement of landmarks on a subset of skulls representing all the CT protocols in the sample found landmark errors of <2.1mm Standard Deviation (SD) (excluding euryon) and an average Interlandmark Linear Distances (ILD) error <1.7%. Euryon was found to be the least precise landmark, primarily in the z-axis (SD=4.1mm), but the imprecision of the landmark did not affect the precision of Maximum Cranial Breadth (XCB) (average error of 0.17%).

For comparison to the FDB, individuals were classified in FORDISC® twice, against all FDB populations and then against those of the same sex in accordance with other population-level studies using FORDISC®. In the all-group comparison, average classification accuracies ranged from 53% for sex and ancestry, to 65% for ancestry, and 81% for sex. The highest accuracy rates occurred among white females for ancestry (91%) and sex and ancestry (77%) and Asian males for sex (100%). When only same-sex groups were compared, classification to the correct ancestry was around 65%. In general, the Asian individuals classified with the least accuracy, but also represent a more diverse set of nationalities than those represented in the FDB. Expansion of the Asian groups in the FDB may enhance the classification of Asian Americans such as those in this study. Correct classifications of CT measurements occurred at above-chance frequencies that were comparable to FORDISC's® own cross-validation rates of the FDB using the same variables. In a comparison of group means for the 17 ILDs included in the FORDISC® analysis, CT scan values tended to be larger than FDB values. Orbital Breadth (OBB) had the largest difference across all groups, suggesting that the way this ILD was collected in this study was problematic due to the inability to locate dacryon. This study reveals that clinical CT scans may be a valuable source of anthropological data provided that the appropriate landmarks can be located. The above-chance classification rates and the low landmark placement/ILD errors suggest the multivariate relationships among FDB individuals can be used to estimate the sex and/or ancestry of modern American individuals using CT scans, opening the possibility for expanded use of CT data in anthropological analyses.

Computed Tomography, FORDISC®, Craniometrics