MA Thesis – Human Skeletal Biology Track, Physical Anthropology - New York University (2011)

THE UTILITY OF OSTEON SHAPE AND CIRCULARITY FOR DIFFERENTIATING HUMAN AND NON-HUMAN HAVERSIAN BONE

Victoria M. Dominguez

Abstract

Distinguishing human from non-human bone fragments is usually accomplished by observation of gross morphological traits. When this method is not sufficient, histological approaches can be applied. Certain traits have been established as characteristic of non-human species, such as plexiform bone and osteon banding. However, in the absence of recognizable non-human microstructural features, histomorphometric methods can be used to distinguish human from non-human Haversian bone.

Two histological variables were considered, osteon area (On.Ar.) and osteon circularity (On.Cr.), as criteria for species identification. The original sample included four species, namely deer, dog, pig, and human. Initial investigation of the cross-sectional slides revealed that the entire pig sample (*n* = 18) was juvenile and composed of woven bone; it was, therefore, excluded from further analysis. The deer sample consisted of ribs (*n* = 6), humeri (*n* = 6), and femora (*n* = 6). The dog sample also consisted of ribs (*n* = 6), humeri (*n* = 6), and femora (*n* = 6). The human sample was composed of ribs only (*n* = 26). The complete rib cross-sections were measured, whereas humerus and femur data was collected by quadrant. Three main questions were addressed: (1) osteon variation across quadrants within long bones, (2) osteon variation across elements within a species, and (3) osteon variation across species.

Analysis of variance (ANOVA) conducted on the mean quadrant data for both deer and dog revealed no significant differences across quadrants in either the humerus or the femur; quadrants for each sample were pooled in all further analyses. ANOVAs conducted on the mean elements data for both deer and dog demonstrated that On.Cr. in the humerus varied significantly from the rib and femur for both species. No other significant differences across elements were found. Lastly, discriminant function analysis (DFA) run on means data demonstrated that deer and dog have overlapping centroids, with humans separating from both. Tests were run using rib only data and pooled element data (i.e., rib + humerus + femur), as humerus differences were assumed to be significant within species but not across species. Results were similar for both data sets. On.Ar. showed better than chance classification of human and non-human samples. On.Cr. proved a poor criterion for identifying human versus non-human bone when applied alone. However, when the variables are combined, human and non-human groups showed 100% separation for rib data and 98.4% separation for all elements. A final set of DFAs was run on individual osteon measurements (*n* = 3032 for ribs only, *n* = 5743 for all elements) and revealed better than chance levels of correct classification for On.Ar. alone and On.Ar. and On.Cr. together, suggesting that very few osteons are needed for accurately identifying human bone using On.Cr.

This work indicates that the combination of On.Ar. and On.Cr. is a valuable histomorphometric tool for species identification from Haversian bone fragments. Contrary to expectations, On.Cr. and On.Ar. were found not to be significantly correlated with one another. Further research should include refining the minimum number of necessary osteons for correct classification, expanding the non-human sample, and expanding the tested elements for both the human and non-human samples. An exploration of the likely biomechanical forces influencing these variables is also desirable.