A Report on the Disposition of Ten Discontinuous Cranial Traits in the Indian Knoll Skeletal Population

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Abstract

One hundred and seven crania (47 male, 46 female and 14 juveniles of undetermined sex), were sampled for 10 non-metric skeletal variants. Associations between trait incidence and age, and trait incidence and sex, were tested for, using contingency tables and the Chi-square test, with a confidence level of alpha=0.05. Previous investigators have claimed that these skeletal variants are free from age and sex effects. No significant association between trait incidence and sex was discovered; however, one trait showed a strong association with age.

Discontinuous skeletal traits appear in most individuals and are characterized as extra foramina, sutural bones, processes, irregular sutures, tori, exostoses and fossae. These traits have recently been recognized by anthropologists as valuable means for determining the biological affinities of prehistoric human populations (2, 6). Employment of these traits can assist physical anthropologists and archaeologists in the reconstruction of population relationships, which in turn, can be applied toward establishing the probable geographic movements of prehistoric man. Furthermore, these traits are valuable for micro-evolutionary studies (5).

Discontinuous skeletal traits were shown to be genetically transmitted and stable under variable environmental conditions (2). In addition, Berry and Berry (2) claim that these traits are non-age and non-sex specific as well as being "discontinuous", *i.e.* not present in all individuals. Because of their discrete nature and their unique qualities, the investigator can assess and score them rapidly, plus pool all age groups and the sexes in the sample, thereby more reliably reflecting the gene pool.

However, Buikstra (3) demonstrated that some of these traits are in fact age specific and sex specific in some populations. Other researchers (1, 4, 7) have submitted findings that suggest some of these traits are inter-related as well as being significantly affected by abnormal environmental conditions, such as cradle boarding.

This study was conducted to: 1) record the incidence of ten discontinuous cranial traits in a prehistoric skeletal population, and 2) to test the hypothesis that discontinuous traits are not age or sex related.

Materials and Methods

Crania of 47 male, 46 female and 14 juveniles were selected from over 1,000 skeletons housed at the University of Kentucky, Lexington. They were excavated from the Indian Knoll site on the Green River in the southern edge of Ohio County, Kentucky. Occupation of the site

was probably between 2500 and 2000 B.C. (Archaic Period, as defined by New World prehistorians). The economy of the Indian Knoll people was based on a hunting and gathering technology (8). Only intact or partially damaged crania were studied. No deformed or pathological specimens were used. Sutural bones in partially obliterated sutures were not scored (3, 7).

Ten traits were recorded (Table 1). These were selected from facial, frontal, lateral, occipital and basilar areas of the skull. They include foramina, sutural bones, fossae and irregular sutures. This selection of traits provides a sampling of the total cranial area. Descriptions and illustrations of these traits were provided by Berry and Berry (2). Unilateral traits were scored for presence/absence. Bilateral traits were scored for presence on the right, left, both sides or absence on both sides.

Tests for trait incidence-age associations were made between two age groups: sub-adults, (0-15 years) and adults (16 years and older). Tests for trait incidence-sex associations were made between males and females of all ages. Associations were tested for significance by Chi-square.

Results

Only one significant association was noted when testing for trait incidence-age associations. The tympanic dihiscence showed a strong age effect (Table 1). No statistically significant associations between trait-incidence and sex were discovered.

For the sub-adult group, there was a total absence of coronal ossicles and fronto-temporal articulation. The absence of these traits in sub-adults as well as the rarity of parietal foramen and epipteric bones for the total sample points to the population's homogeneity.

TABLE 1. *Tests for age and sex associations using Chi-Square Test.*

	Age			Sex		
Trait	Chi-square 0.05	Observed Value	d.f.	Chi-square 0.05	Observed Value	d.f.
Parietal Foramen	7.81	5.22	3	7.81	2.50	3
Coronal Ossicle	7.81	.60	3	7.81	.003	3
Epipteric Bones	7.81	1.45	3	7.81	4.76	3
Fronto-Temporal Articulation	7.81	.34	3	7.81	1.06	3
Mastoid Foramen Exsutural	7.81	5.91	3	7.81	.56	3
Anterior Condylar Canal Double	7.81	2.41	3	7.81	4.16	3
Foramen Spinosum Open	7.81	3.04	3	7.81	2.18	3
Pharangeal Fossa[1]	3.84	1.55	1	3.84	1.65	1
Infra-Orbital Suture	7.81	4.30	3	7.81	1.27	3
Tympanic Dihiscence	7.81	22.44*	3	7.81	6.46	3

[1] Unilateral trait. *Significant at the 0.05 level.

Conclusions

To use discontinuous skeletal traits for establishing biological affinities, measuring genetic distance, or demonstrating movements of pre-

historic man, one must first show that these variants are without sex or age associations. In this way, one can reliably pool a large portion of a skeletal population including both the young and old as well as the sexes (2, 3, 7), and as a consequence, more accurately reflect the population's gene pool.

However, as Buikstra (3) pointed out, pooling sexes and age-groups is not possible for all traits. Indeed, this study supports both Buikstra's and Jantz's findings that there are age and sex specific traits. Buikstra (3) suggested that proper coping techniques be used for such problem traits.

Tympanic dehiscence (a foramen in the floor of the auditory canal) was shown to be age specific in other populations (3, 7) and was proven to be age specific in the Indian Knoll population. It is not known at what age the tympanic dihiscence stops being "a normal developmental event . . . and becomes a developmental anomaly" . . . (3). This trait may also "age" at different rates in different populations (3).

In short, our knowledge of the etiology and ontogeny of traits like tympanic dehiscence is limited. Some early workers have claimed that discontinuous skeletal traits are free of age and sex associations; however, it is strongly suggested from this study, that age and sex first be routinely inspected, before pooling sexes and age groups for comparative studies.

Acknowledgements

Appreciation is expressed to Dr. Anthony J. Perzigian of the University of Cincinnati, whose guidance, assistance and encouragement made possible this study.

Literature Cited

1. BENNET, K. A. 1965. The etiology and genetics of wormian bones. Amer. J. Phys. Anthropol. 23:255-260.
2. BERRY, R. J. 1968. Non-metrical variation in mice and men. p. 103-133. *In* D. R. BROTHWELL [ed.] The skeletal biology of earlier human populations. Pergamon Press. New York, N.Y. 288 p.
3. BUIKSTRA, J. 1972. Techniques for coping with the age regressive nature of non-metric traits. Amer. J. Phys. Anthropol. 37:431-432.
4. HERTZOG, K. P. 1968. Associations between discontinuous cranial traits. Amer. J. Phys. Anthropol. 29:397-404.
5. JANTZ, R. L. 1973. Micro-evolutionary change in Arikara crania: A multivariate analysis. Amer. J. Phys. Anthropol. 38:15-26.
6. KELLOCK, W. L., and P. A. PARSONS. 1970. Variation of minor non-metrical cranial variants in Australian aborigines. Amer. J. Phys. Anthropol. 32:409-422.
7. OSSENBERG, N. S. 1971. The influence of artificial cranial deformation on discontinuous morphological traits. Amer. J. Phys. Anthropol. 33:357-372.
8. WEBB, W. S. 1946. Indian Knoll. The University of Kentucky reports in anthropology. IV (3), Part 1. Univ. Ky. Press, Lexington. 254 p.