



Physical Anthropology Section – 2009

H48 Cranial Suture Closure as a Reflection of Somatic Dysfunction: Lessons From Osteopathic Medicine Applied to Physical Anthropology

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After attending this presentation, attendees will have a great appreciation of anatomy and physiology of the cranium and potential factors that may influence adult cranial suture fusion.

This presentation will impact the forensic community by drawing attention to potential hazards of utilizing a well-known method of determining age in adult skeletal remains.

The construction of an accurate biological profile has long been a cornerstone of physical and forensic anthropology. Among the diverse components of the analysis, the correct determination of age at death has long been considered one of the most challenging. Adult, or degenerative aging, can be fairly ambiguous with large ranges in variation, as seen by the large ranges of standard deviations in a majority of the methods. The foundation behind estimation of age at death determined from mature skeletal remains is anchored on the core principle that the degenerative changes are both uniform and predictable.

One of the most controversial methods of adult age estimation is assessment of cranial suture fusion. Since its conception and application, the technique has been fraught with controversy. Initially, two "rival" schools of thought existed regarding sutural ossification; that they were either a normal progression of age or the manifestation of pathological condition (Hershkovitz et al 1997). The former theory prevailed in the literature, and the work of Todd and Lyon set the standard for utilizing cranial suture ossification as a viable method for aging adult skeleton remains in physical anthropology (1924). However, several issues regarding the methodology and analysis of some of the earlier techniques have recently been called into question (Hershkovitz et al. 1997, Meindl and Lovejoy 1985). Numerous researchers have attempted to refine the method and identify possible confounding factors, with varied results (e.g., Hershkovitz et al. 1997, Nawrocki 1998, Zambrano 2005).

The "confounding factor" at work may be no other than the basic principles of anatomy and physiology of the cranium. The regard for the skull as a static, immobile entity is a view point that is long overdue an intellectual overhaul. Joints, by inherent nature, are designed to provide movement to some degree, and the cranial sutures are no exception. They, like all joints, will remain patent as long as there is motion, and fuse only when the motion has ceased. While the degree of motion present between the cranial bones is small, it has been well documented in medical and neurological studies (Heisey and Adams 1993). It is also noted that severe changes to the skeleton, or somatic dysfunction, can have an effect on the patency of the cranial sutures and may lead to pathological fusion.

Cranial suture fusion and obliteration is best explained as a mechanism of somatic dysfunction rather than a linear, predictable degenerative consequence of aging. To assess the effect of skeletal somatic dysfunction on the fusion of cranial sutures, analysis was conducted utilizing the William M. Bass donated skeletal collection housed at The University of Tennessee. From the collection 100 individuals of known age, race, and sex were randomly selected for inclusion. The analysis was conducted in two phases. In the first phase, each of the crania was scored for cranial suture closure following the methodology outlined in Meindl and Lovejoy (1985). The second phase included a more in-depth analysis of the cranial and post cranial skeletal remains by a physician. The strain pattern, if present, was identified and scored for each crania, along with other areas of somatic dysfunction in the skeleton (e.g., sacroiliac fusion, ankylosing spondylitis, severe scoliosis). A stronger correlation was found between skeletal dysfunction, either cranial or post cranial, and cranial suture fusion than between age at death and fusion rates. Furthermore, the patterns of cranial suture fusion were highly correlated with the identified strain pattern in the cranium, as previously suggested in the neurological literature.

The results from this analysis clearly show a correlation between skeletal dysfunction and cranial suture obliteration, supporting the theory that sutural obliteration is under the influence of a variety of factors, and is not a simple, linear predictor of age. Physical and forensic anthropologists should be cognizant of the possibility that pathological processes may be present that could potentially alter results from age estimation by means of cranial suture fusion.

References:

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Age Estimation, Cranial Sutures, Suture Fusion