



Pathology Biology Section – 2011

G47 The Effect of Cultural Cranial Deformation on Neurological Development: A Beneficial or Disadvantageous Practice?

Anna Williams, PhD*, and Mitzi A. Richards, MSc, Cranfield University, Defence Academy of the UK, Shrivenham, SN6 8LA, UNITED KINGDOM

After attending this presentation, attendees will gain an appreciation of the different methods of cultural cranial deformation and the existing medical conditions that cranial deformation simulates. There are clear similarities between cranial development in individuals with culturally-induced cranial deformation and individuals with different forms of the congenital condition craniosynostosis. Attendees will understand the implications of cranial deformation for the neurological development of the individual, and these will be compared with those with craniosynostosis. Ethnographic material written through participant observation amongst societies that practice cranial deformation, and medical reports of function in craniosynostotic individuals will be examined to determine whether the practice has a beneficial or disadvantageous affect on individuals' neurological function.

This presentation will impact the forensic science community by detailing the effect of artificial or culturally-induced cranial deformation on the neurological function of the individuals. This is of significance to forensic anthropologists as it is a method of body modification that has implications for the survival of the participants. Neurological conditions are known to affect bone morphology, for example bone atrophy due to paralysis. It also allows an appreciation of cranial growth processes and the interrelationships between the cranial vault, base, and face, as well as the foramina that conduct the cranial nerves. An analysis of the morphological changes to the nerve foramina, coupled with an examination of ethnographic accounts of the physical symptoms exhibited by the individuals has not been attempted before, and constitutes a novel contribution to our understanding of cranial deformation in past and existing societies. The modern condition of craniosynostosis can inhibit neurological development, and can offer the forensic anthropologist insight into the physiological consequences of the social practice. This has implications for investigations of human rights violations and the recognition of how social and cultural practices can dramatically affect human physiology.

This project builds on previous research conducted by Dingwall,¹ Schijman,² and Cheverud *et al*,³ among others, to determine whether or

not artificial cranial deformation practiced by past and extant peoples has an effect on neurological function. It aims to refute or support the hypothesis that cranial deformation must have an effect on the development of the brain and the skull and therefore affect neurological function in an observable way.

Intentional artificial cranial deformation, practiced for a variety of cultural reasons, is of great interest to anthropologists due to its value for reconstructing aspects of past and contemporary social systems, as well as understanding modern medical conditions. Deformations have been carried out for many social and aesthetic purposes, ranging from increasing perceived beauty to encouraging obedience in infants. It is associated with instilling ethnic identity and social stratification. This paper addresses the question of whether artificial cranial deformation of infant skulls, as practiced with boards, pads, stones, or bandages, had any adverse or beneficial consequences for neurological development, and whether these were ignored or embraced by the societies practicing the tradition.

Previous research has not made links between cranial modification and ethnographic evidence of abnormal neurological function (whether impaired or improved); however, papers written comparing the skull morphology of modern pathological specimens and ethnographic examples of artificially deformed specimens have shown that some features appear different to un-modified skulls, for example, the patterns of venous sinuses and meningeal vessels, which may affect neurological function.⁴ The resulting consequences of possible neurological change have not been compared to ethnographic data. The paucity of such research may have implications for wider anthropology, as cultural or social phenomena such as tribal demise or proliferation, or shared spiritual experience may be attributed to neurological modification as a result of artificially-induced cranial deformation. Some traits and idiosyncrasies peculiar to distinct peoples may have a neurological foundation.

A study was conducted using two types of artificially deformed crania from the Natural History Museum, London, to examine whether changes in cranial foramina morphology could explain some of the symptoms observed in ethnographic accounts. Cephalic indices and ethnographic accounts of observed effects of artificial cranial deformation were collated, and compared to measurements and documented symptoms and CT scans of individuals exhibiting the medical condition craniosynostosis which appears to express similar morphological changes to the skull. The cephalic indices of artificially deformed skulls were found to be similar to those of skulls with craniosynostosis, which is known to cause an increase in



Pathology Biology Section – 2011

intracranial pressure and precipitate conditions such as strokes and 3rd, 4th, and 6th cranial nerve palsy. This supports the hypothesis that the symptoms exhibited by individuals with artificial cranial deformation would be similar to those with craniosynostosis, and the explanations for the observed symptoms of cranial deformation substantiate the theory that brain function is affected.

This study represents original research that has not been undertaken elsewhere, and constitutes a valuable contribution to anthropological knowledge. It will further the understanding of the nature of cranial deformation, neurological development and pathology, with significant implications for socio-cultural anthropology, forensic anthropology, and medicine.

References:

1. Dingwall E. (1931) *Artificial Cranial Deformation*, London, John Bale, Sons & Danielsson, UK.
2. Schijman E. (2005) Artificial cranial deformation in newborns in the pre-Columbian Andes. *Childs Nervous System* 21(11): 945-50.
3. Cheverud J. Kohn L. Konigsberg L. and Leigh S. (1992) Effects of fronto-occipital artificial vault modification on the cranial base and face. *American Journal of Physical Anthropology*, 88:323-345.
4. Dean, V. (1995b) Sinus and meningeal vessel pattern changes induced by artificial cranial deformation. *International Journal of Osteoarchaeology* 5:1-14.

Cranial Deformation, Neurological Function, Craniosynostosis