H45 Craniofacial Growth, Maturation, and Change: Teens to Mid-Adulthood

Ann H. Ross, PhD, North Carolina State University, Sociology and Anthropology, Campus Box 8107, Raleigh, NC 27695-8107; and Shanna E. Williams, PhD, University of Florida, Department of Anatomy, PO Box 100235, Gainesville, FL 32610-0235*

After attending this presentation, attendees will learn that the craniofacial skeleton attains adult size and shape at a much younger age than previously assumed.

This presentation will impact the forensic community by adjusting current perceptions in regards to the age at which adult craniofacial dimensions are reached.

The different structural units which constitute the craniofacial complex develop and grow under differential mechanical forces. Replacement of cartilage to bone, sutural deposition, and periosteal remodeling are the three principal processes which drive craniofacial skeletal growth. The bones of the cranial base develop through endochondral ossification, which is preceded by a hyaline cartilage precursor largely confined to the spheno-occipital synchondrosis. The vault, facial, and mandibular bones, per contra, develop through intramembranous ossification or tissues that are of neural crest origin.

The neurocranium develops earlier and faster than the craniofacial skeleton in newborns and infants, approaching adult size and configuration by age 10. The slower growing craniofacial skeleton is influenced by tooth eruption, which drives alveolar process development. Thus, an increase or decrease in tooth number or tooth loss during growth will have a direct effect on the shape of the facial skeleton. Craniofacial growth is thought to cease around 17 years of age following eruption of the permanent dentition

Strand Viðarsdóttir and colleagues (2002) found that population- specific facial morphologies are present at birth regardless of sex and are modified during ontogeny, thus suggesting that ancestry can be determined in subadults. Meanwhile, in their cephalometric study of craniofacial changes in the third decade of life, Akgül and Toygar (2002) found significant changes, which were more pronounced in women and the lower region of the face. In order to further examine developmental shape and size differences in the craniofacial skeleton and the potential for the identification of subadults, as well as their possible inclusion in population studies, the present study used geometric morphometric methods to compare individuals from a single population partitioned into four age groups: 14, 16, 20, and 25+ years. Twenty-six type 1 and type 2 standard coordinate landmarks were used in this study. The sample consists of 4 fourteen-year-olds, 5 sixteen-year-olds, 3 twenty-year-olds, and 12 twenty–five-year-olds and is derived from an African slave population housed in the Morton Collection at the University of Pennsylvania. After GPA superimposition of the raw coordinates, the resulting shape variables and Centroid Size were utilized in the subsequent multivariate analyses. A multivariate analysis of variance (MANOVA) test using the first ten principal component scores corresponding to 83% of the total variance detected significant shape differences among the age groups (F= 1.92; df = 30, 32.96; Pr > 0.0355). In addition, the “contrast” statement d in the proc GLM procedure was used to detect the specific groups that differed. Surprisingly, the groups that differed significantly were the 20 and 25+ age groups (F= 3.64; df = 10, 11; Pr > 0.0224). In addition, a Pearson Correlation Coefficient was used to examine the relationship between shape variation using the Principal Component scores and Centroid Size. No significant correlation was detected between the PCs and Centroid Size for the sample as a whole, meaning no significant scale differences were detected. These results suggest that there is no significant shape or size differences between older subadults in their mid teens and adults, thus signifying that subadults reach their final form earlier than expected. The significant difference between 20-year-olds and the over 25 group concurs with the study by Sarnas and Solow (1980) who found displacements in nasion and sella between 21 and 26 year olds. The changes between the 20 and 25+ age groups are probably multifactorial in nature and related to the eruption of the third molars and/or possibly alveolar remodeling due to the aging process. These studies have clinical as well as forensic implications for the identification of subadult and adult crania.

Craniofacial Growth, Teens, Adults

 ** Presenting Author*