

Both parametric and non-parametric tests show that M_1 molar flare values do not differ significantly among dietary categories ($F = 3.35$, $p = 0.063$, $X^2 = 3.55$, $p = 0.17$), and molar flare is not significantly associated with diet ($G_{adj} = 7.07$, $p > 0.10$). When molar flare categories are mapped onto the cladogram of Begun *et al.* (1997), relatively flaring molars are observed in the outgroup (*Aegyptopithecus*) and early Miocene stem hominoids, while Middle and Late Miocene and extant apes exhibit reduced molar flare. Thus molar flare is not a functional correlate of diet, but appears to be a primitive trait for Miocene hominoids. Functional and phylogenetic implications of molar flare reduction are discussed.

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47. The role of cross-sectional cortical morphologies in interpreting habitual bending across the anthropoid hip: A comparative analysis.

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Cross-sectional morphologies of anthropoid femoral necks are considered sensitive characteristics for interpreting changes in habitual loading during the evolution of bipedality. However, recent data challenge the reliability of these characteristics. The present inquiry focused on the use of cortical cross-sectional shape and robusticity in interpreting differences in habitual loading across hip regions of hominids versus great apes - where hominid femoral necks reputedly have relatively distinct loading, characterized by habitual bending. This question was examined in a comparative context by performing geometric analyses on proximal femora of adult modern humans ($n=23$) and chimpanzees ($n=23$), and calcanei of sheep ($n=15$), deer ($n=21$), and horses ($n=15$). The calcanei are well-established "tension/compression" bones, documented by *in vivo* or finite element analyses. To facilitate comparisons, all bones were modeled as beam-like structures with "end" loading, and each was transversely sectioned in the respective functionally analogous locations: at 20%, 50% and 70% of "beam" length in calcanei, and mid-neck, basal neck, and subtrochanteric in primates. The computer program SLICE was used to digitize tracings and calculate: 1) "Robusticity" = cortical area to total (subperiosteal) area ratio (CA/TA), and 2) "Circularity" = cortical cross-sectional shape, or the ratio of maximum to minimum second moments of inertia (I_{max}/I_{min}). Radiographs were visually evaluated for

arched trabecular patterns, which, if present, may reflect adaptation for tension/compression stress trajectories. Results demonstrate that the human mid-neck and the calcaneal distal (20%) sections have similar circularity and robusticity. In contrast, the chimpanzee mid-neck was significantly more circular and robust ($p < 0.05$). The chimpanzee femur was the only bone that did not clearly demonstrate arched trabecular patterns. These results demonstrate that the human femoral neck sections have cross-sectional morphologies similar to the free ends of the tension/compression bones-the chimpanzee femur clearly deviates from this pattern. Although the calcanei and human femoral neck share these areal characteristics, it is still premature to suggest a causal relationship with a habitual tension/compression loading regime. Additional investigations are warranted using other characteristics, such as predominant collagen fiber orientation, that are more sensitive and specific to these strain modes.

A comparative cross-sectional study tracking maxillary sinus (MS) growth in *Pan* and modern humans: How similar are they?

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Among catarrhines, only the African great apes and humans exhibit all four paranasal sinuses (PNS) (Márquez *et al.*, 1999, 2000; Koppe *et al.*, 2000). Of these, the PNS morphology of the common chimpanzee appears to parallel the human configuration more closely than the gorilla (Márquez, 1999). However, the mode and tempo of chimpanzee PNS development has yet to be fully examined. For this present study, we track the growth and development of the largest sinus within the PNS system-the MS-in an ontogenetic series of humans and chimpanzees. Quantification of MS volumes based on computer tomography (CT) was undertaken to assess the degree of developmental similarity and evaluate the ontogeny of MS expression between these intimately related genera.

A cross sectional series of dry crania representing a mixed sex sample of both *Pan* ($n=24$) and *Homo* ($n=44$) were selected from the American, Cleveland, and National Museums of Natural History. A CT data base of human patients ($n=67$) with non-respiratory disorders were also included from UT Medical Center and Mount Sinai School of Medicine. Developmental stages were determined by dental eruption

patterns. Volumetric determinations were performed from multiplanar reformatting and 3D reconstruction of CT digital data. Results show of the two major growth spurts (GS) in *Homo*, the largest occurs between M1 and M2 eruption. The pattern was maintained in *Pan*, but an additional GS was observed after M2 eruption and prior to canine emergence.

Although the added GS in chimpanzees may reflect a developmental retention from a common ancestor, the parallel ontogeny of MS expression in humans and chimpanzees supports the cytologic and molecular sequence evidence that these genera are closely related.

Mid-sagittal cranial variation in geographically distant modern human populations.

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Mid-sagittal differences in the shape of crania from geographically distant modern human populations were studied using geometric morphometric methods. Samples included Austrian Europeans ($n=85$), Khoi-San Africans ($n=34$), Australians ($n=14$), and New Guineans ($n=5$) with 2-dimensional coordinates for landmarks prosthion, nasion, bregma, lambda, inion, opisthion, and basion.

After Generalized Procrustes Analysis with unit centroid-size scaling, pairwise randomization tests of overall shape identified significant, Bonferroni-corrected differences between the Austrian-Europeans and all other groups ($P=0.001$) and between the Khoi-San Africans and the Australians ($P=0.003$). A suggestive, but non-significant, difference was found between the Australians and New Guineans ($P=0.055$), but very little separation exists between the Khoi-San Africans and New Guineans ($P=0.787$).

Examination of thin-plate spline grids between population means suggests that in the mid-sagittal plane the Austrian Europeans and Australians have rounder heads and the Khoi-San African and New Guineans have more elongate heads. A pronounced rotation of the foramen magnum is evident in the Europeans, and pronounced prognathism local to the face is seen in the Australians and New Guineans. Differences between the facial shape of the Khoi-San Africans and that of the Austrian Europeans is detectable, but the difference appears attributable to the relative elongation of the African crania and greater mid-sagittal roundness of the European skulls.