ABSTRACT

VERTICAL CLIMBING ADAPTATIONS IN THE ANTHROPOID ANKLE AND MIDFOOT: IMPLICATIONS FOR LOCOMOTION IN MIOCENE CATARRHINES AND PLIO-PLEISTOCENE HOMININS.

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Vertical climbing has featured prominently in hypotheses of early hominoid evolution and the origins of hominin bipedalism. The ankle is a critical region for determining how the foot will be positioned against a tree, and the morphology of this joint may be specifically adapted for vertical climbing in species that practice this form of locomotion. This dissertation tests the hypothesis that the skeletal and ligamentous morphology of the non-human hominoid ankle and midfoot is adapted for bouts of vertical climbing. I employ a multifaceted approach using evidence from kinematics of wild and captive primates, radiographs, dissections, EMG studies, biomechanical data on baboon ankle ligaments, and linear, angular, and 3D surface morphology measurements of the distal tibia and tarsals of extant anthropoids. Results are applied to the ankle and midfoot of early Miocene catarrhines and Plio-Pleistocene hominins to assess whether vertical climbing was a significant component of their locomotion.

Analysis of video captured of wild chimpanzees vertically climbing reveals that apes orient their foot in positions of extreme dorsiflexion and inversion during vertical climbing bouts. Functional correlates of vertical climbing in the ape ankle include a

mediolaterally expanded anterior aspect of the distal tibia, a robust medial malleolus, and a weakly developed posterior tibiotalar ligament. Most tibiae and tali from early Miocene catarrhines are cercopithecoid-like for these features, although *Proconsul major* and *Rangwapithecus* seem to have possessed ankles able to adopt positions of dorsiflexion and inversion. None of fossil hominin tibiae or tali from 4.12 million to 1.53 million years ago is adapted for positions of extreme dorsiflexion and inversion and thus early hominins probably did not engage in ape-like vertical climbing. Instead, adaptations for bipedality in the hominin ankle result in a joint maladapted for vertical climbing. Though many of these adaptations for bipedality evolved in the hominin ankle by 4.12 mya, the evolution of the stabilizing anterior talofibular ligament was a relatively recent event, occurring perhaps in *Homo erectus*. The morphology of the tarsometatarsal joint also reveals that early hominins possessed a stable lateral midfoot and perhaps a longitudinal arch which would have restricted grasping and hindered arboreality.