3D ANALYSIS OF HIP JOINT MOBILITY AND THE EVOLUTION OF LOCOMOTOR ABILITIES IN MIOCENE HOMINOIDS

Ashley S. Hammond

Dr. Carol V. Ward, Dissertation Supervisor

ABSTRACT

The emergence of extant ape-like locomotor behaviors has become a defining issue in reconstructing ape evolution. Suspensory positional behaviors, such as antipronograde bridging, climbing, clambering and transfer, distinguish extant hominoids from Old World monkeys and most New World monkeys. It has been widely theorized that suspensory behaviors involve highly abducted hip joint postures, potentially permitting suspensory behaviors to be inferred from joint function rather than relying on isolated morphologies. This thesis tests whether adaptations for suspensory behaviors can be inferred in fossil nonhuman hominoids from the hip joint.

The first study tests the association between suspensory behaviors and hip mobility in anesthetized living anthropoids (n=104). Suspensory taxa were found to have significantly higher passive ranges of abduction and external rotation compared to non-suspensory taxa.

The second study developed a digital modeling technique to estimate range of hip abduction and then tested the accuracy of the modeling approach against the live animal data. Hip joint abduction and the abducted knee position were reconstructed in a large sample of extant anthropoids (n=252) and then quantitatively compared these simulations to the *in vivo* data for passive range of abduction. Suspensory taxa were significantly larger in both simulated abduction (degrees) and abducted knee position

(mm), although there was overlap between locomotor groups. The results provided a hypothetical framework for how to interpret abduction modeled in fossil taxa.

The final study modeled hip abduction in early Miocene hominoid *Proconsul nyanzae*, late Miocene crown hominoid *Rudapithecus hungaricus*, and several large-bodied Plio-Pleistocene fossil cercopithecoids (*Paracolobus mutiwa*, *Paracolobus chemeroni*, *Theropithecus oswaldi*) using the validated modeling approach from the second study. Abduction simulations in *Proconsul nyanzae* and fossil cercopithecoids yielded abduction consistent with a non-suspensory locomotor reconstruction. Abduction in *Rudapithecus hungaricus* was exclusively in the range of extant suspensory anthropoids and was most similar to the values observed in spider monkeys and hylobatids. This study provides the first evidence for suspensory behavior in a Miocene ape based on joint function.