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FUNCTIONAL MORPHOLOGY OF ANTHROPOID HAND POSTURES: A 3D APPROACH TO PHALANGEAL ARTICULAR SURFACES

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Many of the most fundamental and still unresolved questions in paleoprimatology stem from our limited understanding of the evolution of primate locomotor behaviour. Phalangeal morphology is routinely used to infer fossil primate positional behavior and locomotor adaptations. While it is widely accepted that shaft curvature is an adaptive response to the habitual stresses of locomotion, relatively little is known about the functional morphology and scaling relationships of phalangeal articular surface area and shape (i.e., joint depth, slope). Given that manual phalanges are in repetitive direct contact with substrates, and that discrete locomotor behaviours are characterized by unique phalangeal orientations with dissimilar patterns of mechanical loading, it is reasonable to predict that proximal articular surface area and shape are a response to locomotor-specific patterns of mechanical loading. This study employs 3D shape analysis to test the hypothesis that anthropoids who load their phalanges in compression (i.e., palmigrady, digitigrady, knuckle walking) will have larger and deeper proximal articular surfaces than anthropoids who load their phalanges in tension (i.e., suspension). Surface areas were obtained from 16 anthropoid genera (n=187) with diverse locomotor adaptations, and comparisons of articular surface shape and depth were made between discrete locomotor groups. According to predictions, taxa with hand postures that load the phalanges in compression have relatively larger and deeper articular surfaces, however maximum depth is also influenced by phylogeny. Multivariate analyses demonstrate that articular surface shape (i.e., location of maximum depth) within discrete phylogenetic groupings (i.e., hominoids, cercopithecoids, ceboids) varies according to locomotor adaptation and hand posture.

Keywords: phalanges, anthropoid, locomotion, posture