COMPUTATIONAL MODELING, ONTOGENY, AND BIOMECHANICS OF CRANIAL FORCES IN *ALLIGATOR MISSISSIPPIENSIS*

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ABSTRACT

3D computational modeling offers researchers tools to investigate forces in the skull during feeding and other behaviors. The American alligator and other crocodylians generate the highest bite forces among vertebrates, leading to their ecological and evolutionary success. Because the platyrostral skulls of alligators require substantial mediolateral components of muscle forces, accurately modeling cranial forces requires the use of three-dimensionally accurate anatomical data. However, many previous modeling studies were carried out in two dimensions, ignoring the mediolateral aspect of force. To test the utility of 3D models in estimating cranial function, I used CT scanning developed 3D lever and finite element analyses (FEA) and applied them to an ontogenetic series of alligators. Dissection and CT scanning were used to model muscle forces, and 3D lever analyses and FEA were used to model joint reaction forces and bite forces. To validate these modeling techniques, I compared calculated bite forces to those measured *in vivo* in *Alligator mississippiensis*. Modeled forces matche\d *in vivo* data well and scaling patterns of input and output forces were determined. My results show that these techniques accurately predict forces in the skulls of crocodylians, and can be used in studies involving fossil and extant crocodyliform taxa as well as other vertebrate species.