Researchers Test Canine Tooth Strength for Clues to Behavior of Early Human Ancestors

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Measuring and testing the teeth of living primates could provide a window into the behavior of the earliest human ancestors, based on their fossilized remains. Research funded by the National Science Foundation and led by University of Arkansas anthropologist Michael Plavcan takes us one step closer to understanding the relationship between canine teeth, body size and the lives of primates.

In an article published in American Journal of Physical Anthropology, Plavcan and colleague Christopher B. Ruff of Johns Hopkins School of Medicine report on an initial examination of the function of the shape of canine teeth in primates. This is the first published comparative analysis of canine strength for primates.

Understanding more about the function of canine teeth can lead to new models for understanding human evolution. Plavcan has been studying primate teeth and skulls for 24 years and spent four years collecting dental data for this analysis.

The researchers compared the size, shape and strength of canine teeth from 144 primates with similar measurements taken from 45 carnivores. They examined the relationship of the size of primates' canines to body size and the relative strength of the teeth. This comparison could help answer the speculation about the function of male primates' canine teeth in the competition for females. Are the canines used as weapons or simply for display?

The reason we wanted to use the carnivores is that we know carnivores use their canines for killing," Plavcan said. "If primates' canines are too weak to function as weapons, then they're all just for show."

Among anthropoid primates, it is well known that the canine teeth of males are up to four times as long as those of females. The researchers compared the canine teeth of male and female primates.

If the male's canines are stronger than the female's canines that would imply there is sexual selection for strength and that the tooth is actually used as a weapon," Plavcan said. Female's canines are short, and shorter, stubbier objects are harder to break. So, if the long, thin male canines are as strong or stronger than those of the female, that would also suggest they are capable of being used for fighting."

The results were mixed in an interesting way.

We found that the primate canines are generally as strong as or stronger than carnivore canines," Plavcan said. "But they are not associated with any sort of estimate of sexual selection.

Generally the canines of males and females were equally strong. Given that primates have such strong teeth in general, the researchers suggested a couple of possible explanations. It could be that all primate males have strong teeth because of a significant risk to reproductive success for any male who breaks a canine tooth. Or it could be that the strong teeth are due to basic inherited design.

Hominids the primate family that produced humans – retain body mass sexual dimorphism; that is, males typically have a greater body mass size than females. At the same time, the difference in size in canine teeth between males and females is lost.

This goes back to the earliest hominids," Plavcan said. In fact, one of the few diagnostic characteristics of hominid evolution is reduction in canine size dimorphism while maintaining strong body mass dimorphism.

For example, gorillas have chunky teeth set in massive bodies. To have canines proportionately as long as other primates, a male gorilla's canines would have to be 25 centimeters long, and the teeth at the base would then be too wide for his jaw.

This suggests that there may be an upper limit on canine size in primates simply due to spatial constraints on fitting such teeth in the jaws, the researchers wrote.

The difference in body size between male and female hominids has been the subject of study because it is an obvious and important trait. Yet there are drawbacks to using body size to understand sexual selection. A change in body size can impact many other aspects of life, including metabolism, feeding patterns and vulnerability to predators. Canine teeth, on the other hand, are a far simpler system.

With canines, we can go in and effectively construct an experiment that allows us to control for all these other variables and look at only one thing," Plavcan said. "The same phenomenon that works on the canines, we can translate into the body mass and then into behavioral models for the fossil record.

Source: University of Arkansas

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