What teeth reveal about the lives of modern humans

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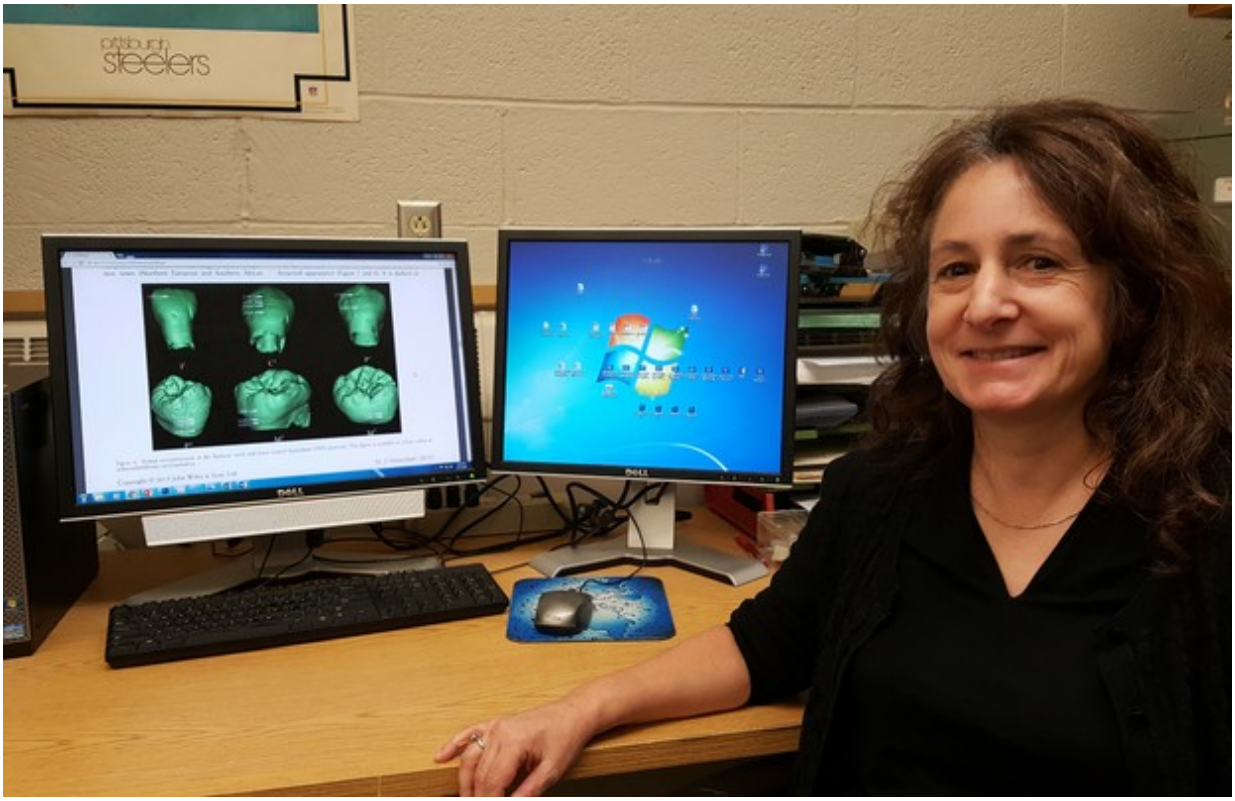

Credit: Debbie Guatelli-Steinberg

When anthropologists of the future find our fossilized teeth, what will they be able to conclude about our lives?

Debbie Guatelli-Steinberg has an idea. She is a professor of

anthropology at The Ohio State University who studies fossilized teeth to answer questions about the life history, growth, and diet of primates and our human ancestors, as well as the relationships between different species.

In a new book, What Teeth Reveal About Human Evolution (Cambridge University Press, 2016), she gives a broad overview of what scientists have learned about our ancestors from studying fossilized teeth.

As for the teeth of humans living today - well, it is a good thing we have modern dentistry.

"We have teeth that were adapted for eating a very different diet than the one we eat today, at least in Western societies," Guatelli-Steinberg said.

In the book, she noted that 99 percent of humans' evolutionary history was spent eating foods that were hunted or gathered. Our current diets of soft, processed and sugary foods are nothing like the diets for which our teeth are adapted.

"Problems like cavities and plaque buildup have been magnified tremendously in humans today," she said. "Natural selection has not prepared us well for the kinds of food we eat today."

In addition to having much higher rates of cavities and plaque, modern humans are much more likely to have misaligned teeth that require orthodontic treatment or surgery.

"Soft diets do not stimulate jaw growth, and teeth, especially our third molars (wisdom teeth), become impacted," she said.

In fact, third molar impaction became 10 times more common after the

Industrial Revolution than it was previously.

Researchers like Guatelli-Steinberg learn a lot about early humans and our ancestors through an examination of teeth.

One reason that teeth provide so much information is simply that they are available. Teeth are the most preserved skeletal remains found in fossils. They are small and very mineralized, making them resistant to decomposition and able to maintain their original qualities, she said. Teeth also contain a record of a lot of aspects of their own development, including their chemistry and pathology.

"Teeth give us insights into a variety of aspects of evolution," she said.

For example, researchers study the structure of teeth - like bumps and grooves - to see how species are related to one another.

Also, since the scale of dental development is related to overall development in most animals, researchers can use teeth to determine how long it took individuals of different species to grow to adulthood.

On the other end of life, researchers can study the amount of wear on fossilized teeth to get a very rough estimate of how old an adult was when he or she died.

And, of course, there is much to learn about diets.

Microscopic wear on the chewing surfaces of teeth can suggest what kind of food an individual ate.

"Different kinds of food can require different ways of bringing the teeth together. As that happens, the food will mark the teeth in different ways, depending on their properties," she said.

The chemical composition of the teeth themselves is revealing. Scientists can identify the stable isotopes and trace elements in fossilized teeth to determine an individual's diet.

Much of Guatelli-Steinberg's own research has focused on using patterns of tooth growth to assess what life was like for the individuals under study.

"Tooth growth is disrupted in periods of severe physical stress, such as illness or starvation, so teeth can be a window to challenges that our ancestors faced," she said.

In a 2004 study, Guatelli-Steinberg and colleagues used a scanning electron microscope to compare fossilized teeth of Neanderthals with those of modern Inuits, or Eskimos. The researchers were looking for tiny defects - horizontal lines and grooves in tooth enamel - that suggest the individuals were experiencing stress.

The results showed that Neanderthals did not have lives that were dramatically more difficult than those of the modern Eskimos - a finding that challenged traditional thinking at the time.

More recently, Guatelli-Steinberg has used a relatively new method of studying fossilized teeth to examine growth increments. The technique pioneered by anthropologist Tanya Smith, called X-ray synchrotron microtomography, uses a specialized imaging machine to see inside teeth without having to cut them up.

This allows researchers to create virtual sections of fossil teeth to see periods of growth, or when growth was interrupted, in increments as short as just a few days, she said.

Regardless of what new techniques are developed to study teeth, Guatelli-

Steinberg said she expects future anthropologists will "likely have a field day" studying modern human teeth.

"In various cultures today, we have people who notch teeth, inlay them with jewels or gold, lengthen them, file them down and remove them altogether," she said.

"One can only imagine what anthropologists will make of all the things we do to our teeth today."

Provided by The Ohio State University