In her book *What Teeth Reveal About Human Evolution* (Cambridge University Press, 2016), anthropologist Prof. Debbie Guatelli-Steinberg describes what fossilised teeth reveal about history and the living conditions of our ancestors. One finding is that the high proportion of soft and sugary food people consume in the Western world these days is to blame for the steady rise of dental problems such as dental decay and malocclusion. Dental Tribune had the opportunity to speak to the Ohio State University professor about the causes of this development and the impact her research may have on modern life.

### What can teeth reveal about earlier life and human evolution?

**Prof. Debbie Guatelli-Steinberg**

Teeth make up most of the mammalian fossil record, and this is true for human evolution as well. The reason: teeth are heavily mineralised, so they resist destruction and decomposition. The fact that teeth are likely to fossilise is extremely convenient for physical anthropologists because teeth lock detailed information about diet and dental development into their physical and chemical structure. The book is meant to synthesise insights into human evolution that researchers have gleaned from teeth—those insights include the recognition that human diets began to diverge early in hominin evolution, that human diets began to diverge early in hominin evolution, and that human diets began to diverge early in hominin evolution.

**What sparked your interest in this field of research initially?**

I have always had an interest in human evolution and non-human primates, and when I began my doctoral program at the University of Oregon, I met Prof. John Lukacs, who used teeth to answer questions related to these topics. This seemed like a really fascinating thing to me—that one could find out so much from fossil teeth.

**How does one decode the information garnered from fossilised teeth?**

One can gain information about growth rates and development in teeth or about the morphology of teeth, but that information requires a broader context for interpretation. For example, human first molars erupt at around six years of age, but that fact does not tell one much unless one compares it with other mammals, especially non-human primates. Dogs grow up fast and their first permanent teeth erupt around six months of age. They are not much smaller and die much earlier than we do (which is sad for dog owners). Chimps erupt their first molars more on the order of four years of age and do not appear to have natural lifespans that are as long as ours. In other words, rates of dental development reflect the developmental rates of species, but we would not really know that unless we compared humans to other primates. This applies to fossil teeth too: we need a broader comparative context to understand the indications they give us.

In your new book, you say that our teeth were adapted for a very different diet than the one we eat in Western societies today. Could you explain that briefly? What are the (negative) consequences of this change in diet?

Yes. Over most of our evolutionary history until the rise of agriculture around 10,000 years ago, we humans were foragers, eating food that could be gathered or hunted. Those kinds of foods are the foods that our teeth are adapted to eat. With the rise of agriculture, and particularly with the more recent introduction of processed and sugary foods into the diet, there was an enormous increase in dental malocclusion and pathology. Essentially, we are not adapted to the diets we eat today; as these dietary changes are quite recent in our evolutionary history, our dental problems, such as the high prevalence of dental caries and periodontal disease, are man-made evolutionary developments.

Would you say that today’s dental problems, such as the high prevalence of dental caries and periodontal disease, are man-made evolutionary developments?

Well, it is possible to find dental pathologies in ancient hominin fossils, but only in a handful of individuals. So, I would say that, although dental pathologies did occur early in human evolution, we were nowhere nearly as frequent as they are today.

### The oral environment had changed to provide an optimal environment for caries-causing strains to flourish.

**Why is that? When considering the causes of this change in diet?**

There were no dentists or even oral hygiene products around, one imagines our ancestors must have been toothless by their mid-20s. With the softer, more cariogenic foods eaten in an agricultural diet, the oral bacterial environment changed. One scientist, Dr Christina Adler, from the University of Adelaide and her colleagues, sequenced bacterial DNA obtained from dental calculus adhering to the teeth of early hunter-gatherer and early European agriculturalists. What they found was that, with this change in the oral environment, and later with the production of processed sugar during the Industrial Revolution, the diversity of oral flora decreased, with caries-causing strains becoming predominant. Essentially, the oral environment had changed to provide an optimal environment for caries-causing strains to flourish.

**How about primitive tribes that are largely untouched by civilisation even today. Is their dental status significantly better than that of people living in industrial regions?**

When people who were not eating a Western processed and sugary diet are all of a sudden introduced to one, their rates of dental disease go up. So, for example, native Eskimos had very little by way of dental caries until they were introduced to processed foods and sugary sodas, and then their rates of caries increased dramatically.

I have read that breastfeeding provides optimal oral mechanical stimulation for the jaw’s normal development. Given the decrease in breastfeeding, could that mean modern children are at a higher risk of developing malocclusion and requiring orthodontic treatment?

That is a great question, but as I am not a dental practitioner, I do not have a great answer! I can tell you that Prof. Robert Corruccini’s pioneering experimental studies on baboons (which rarely show malocclusions) showed that soft diets led to dental crowding and rotations of teeth. Essentially, without foods that were hard or tough, bone growth in the baboon jaw was not great enough to accommodate the animal’s teeth.

What role does genetics play in influencing teeth, oral health and jaw development? Since evolution is a process of hundreds and thousands of years, it is probably not possible to turn back the wheel of time just by sticking to a certain diet.

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**“The oral environment had changed to provide an optimal environment for caries-causing strains to flourish.”**

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**An interview with Prof. Debbie Guatelli-Steinberg, US**

*By Kristin Hübner, DTI*