

UPenn Researchers Announce Discoveries that Could Help Understand Severe Tooth Decay in Early Childhood

By Nora Al Baghdadi

Researchers led by Dr. Hyun (Michel) Koo of the [University of Pennsylvania's School of Dental Medicine](#) has found new insight into the causes of severe tooth decay in preschool age children. The decay they studied was highly aggressive and typically resulted in such severe dental problems that surgery was often required to repair the damage.

Professor Koo is a member of the Department of Orthodontics at the University of Pennsylvania. He has spent fifteen years studying how dental plaque, also known as biofilms, interact with microbes. For this project he collaborated with researchers from other universities, including Megal L. Falsetta, Damian J. Krysan, and William H. Bowen from the University of Rochester Medical Center.

For the research, Koo and his colleagues examined the interactions between a particular bacteria, *Streptococcus mutans*, which most researchers have viewed as the main cause of severe tooth decay, and the fungus *Candida albicans*. The research was unique because it offered the team insight into the role of the *Candida* fungus in the development dental plaque. In most situations, the fungus was found to live largely in other parts of the mouth, but was not believed to live well in teeth. This made the initial discovery, that the fungus was found along with the bacteria in most cases of early childhood severe tooth decay, surprising.

The team from the University of Pennsylvania discovered that the *Streptococcus mutans* bacteria used an exoenzyme to produce extracellular polysaccharides from sugar on the teeth. These polysaccharides was then used by the *Candida* fungus to produce another substance, with glue-like behavior, on the teeth. This substance, a polymer, allowed the fungus to stick to the teeth and bind to the bacteria. Under this unique system, the fungus was actually contributing to most of the plaque build-up on the teeth. When the two organisms worked together, the amount of the plaque and the amount of the infection found in the teeth greatly increased.

As the plaque around the teeth increased, it created pockets with a low pH. The decreased pH means that there are higher levels of acid near the teeth. The acid contributes to the dissolving of the enamel, which results in cavities in the teeth. When the discoveries made during this experiment were tested in rats, Koo announced that when the fungus and bacteria worked together, they doubled the number of cavities in the rodents and made them more severe.

Dental plaque has been causing problems for humans since the shift towards a more agricultural based diet, which is responsible for bringing sugar and starch into the diet. Researchers in the past have found that while caries are common in skeletons from the Neolithic era, those from the Paleolithic era did not seem to be affected. Koo says that had hypothesized that these severe cases of dental decay in early childhood was caused by dual infections by both the *Streptococcus mutans* and the *Candida albicans* along with regular exposure to sucrose. The findings in this experiment supported this hypothesis.

Koo and his team have published the results of this study in the journal *Infection and Immunity*. They hope that the new information will help lead to better understanding of the causes of decay in children and also lead to greater insights about how to prevent these initial infections and prevent the potentially devastating dental problems.

This study offers valuable insight both for researchers looking to better understand dental infections and for the parents and professionals caring for the dental health of young children. As more insight is gained, hopefully fewer children will have to face this level of dental decay.