How caries-causing bacteria can survive in dental plaque

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Credit: Universität Basel

Cariogenic bacteria live in biofilm and attack dental enamel by converting sugar and starch into acids that dissolve out calcium from the enamel. This process can cause caries. The dissolution of calcium increases the concentration of calcium locally, creating an environment that is hostile to bacterial life. In their study, the researchers investigated how bacteria manage to survive in dental plaque despite these conditions.

They hypothesized that extracellular polysaccharides (EPS) support the bacteria's survival capabilities. EPS are substances that build extracellular cariogenic bacteria from sugar residue. They create the biofilm's scaffolding and ensure that bacteria are able to anchor themselves in the dental plaque.

EPS integrate calcium into the biofilm

The study showed that the more calcium cariogenic bacteria dissolve, the greater their calcium tolerance and survival capability in the biofilm becomes. The scientists were able to prove that cariogenic bacteria develop mechanisms to help them survive the high concentrations of calcium.

They demonstrated that extracellular polysaccharides possess a high number of calcium binding sites through which they can integrate the free calcium into the biofilm. This neutralizes the toxic substance and strengthens the EPS structure of the biofilm.

New insights into the causes of caries

The EPS' integration of calcium doesn't just help cariogenic bacteria to survive in dental enamel; it also causes caries. "EPS' integration of calcium inhibits the remineralization of the enamel, as there is no longer sufficient free calcium present in the plaque. This discovery is important in gaining a better understanding of calcium regulation in caries," explains microbiologist Monika Astašov-Frauenhoffer.

More information: Monika Astasov-Frauenhoffer et al. Exopolysaccharides regulate calcium flow in cariogenic biofilms, *PLOS ONE* (2017). DOI: 10.1371/journal.pone.0186256

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