How Subgingival Plaque Biofilm Gets Started

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Research articles and textbooks describe supragingival and subgingival plaque as two quite different substances, based on location and bacterial makeup. Studies have demonstrated that the composition of supragingival plaque will influence the composition of subgingival plaque and other studies show that disruption of supragingival plaque will have an impact on subgingival plaque growth. But are they really totally different?

Discussing supragingival and subgingival plaque as different is due in part to the understanding researchers had of bacterial plaque before the concept of a biofilm was introduced to the dental world by engineers. Until plaque was studied in its natural environment, using laser confocal microscopy and computer imaging, our knowledge of supragingival and subgingival plaque was limited to microscopic evaluation of dried bacterial specimens with no fluid or polysaccharide biofilm structure. Researchers focused on identification of the bacteria in plaque, with no information about the structures in which the bacteria lived. Dental researchers wanted to know which bacteria were in plaque. It was the engineers who wanted to know how the bacteria functioned in the plaque or as they called it—biofilm. Did they live in single-family dwellings or multispecies high-rises? How did they get around? How did they communicate with each other? Cell phones? Text messages? How did they bring nutrients in and get rid of waste materials? Did biofilm move?

To answer these questions, engineers built tiny stages on which the bacteria could form a biofilm in a constant stream of saliva and crevicular fluid. Taking digital images through the biofilm allowed them to see and answer their questions about how bacteria function in a biofilm.

Supragingival plaque begins forming within minutes after the teeth are cleaned. The early pioneer colonizing bacteria begin the process and are soon joined by hundreds of other bacterial species and yeasts. Clinically we can’t actually see early supragingival plaque, but we know it’s there. As the mass increases, we can disclose it with dyes and see and feel it through careful disruption with a probe or explorer.

The supragingival bacterial biofilm will begin to form on surfaces protected from direct tongue and cheek movement, along the gingival margins for instance. The biofilm will attach to surfaces in a moist environment based on the shear forces of fluid in the area. It attaches well enough to resist removal by salivary flow or gingival crevicular fluid (GCF) flow. Have you ever noticed that plaque is easier to remove next to healthy tissue compared to tissue inflamed with gingivitis? GCF flow increases in the presence of gingivitis, thus a stronger shear force requiring plaque to attach with greater adherence in these areas. More plaque biofilm will accumulate next to inflamed gingival tissue, as the food source is better for the bacteria.

In a healthy mouth, supragingival plaque biofilm forms before subgingival plaque biofilm. Disclosed plaque in the mouth doesn’t appear to move, but biofilms are actively moving masses of bacteria and slime. Biofilm ripples, streams, rolls, creeps and actually moves microscopically along tooth surfaces. This explains how supragingival plaque actually creeps subgingivally. As it moves into the sulcus, the environment changes, which is inviting for some bacteria and not so inviting for others, thus the change in bacterial composition between supragingival plaque and subgingival plaque.

Supragingival and subgingival plaque are actually a continuous biofilm in the beginning, creeping from exposed tooth surfaces into the sulcus. As the subgingival bacterial biofilm increases in mass and triggers gingivitis and periodontitis, it becomes distinctly different from supragingival plaque. Look closely at the biofilm forming on the tooth surfaces you encounter in your patients. There’s a lot going on in that complex ecosystem!