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NuPath® Bioactives: A More Enlightened Approach to Oral Biofilm Management

David J. Shuch, DDS, Chief Science Officer
CS Bioscience Inc.

Various trends are emerging in the field of oral biofilm management. Effective biofilm management is an important aspect of oral therapy, especially for home care treatment, particularly for those individuals who have oral degenerative issues such as caries, gum disease, oral ulcers, or xerostomia. Historically, the most common approach has been the use of various surfactants to try and emulsify the biofilm (in consort with toothbrushing) and, while emulsified, rinse it away. Various essential oils have been added as antimicrobials. More recently, triclosan, a potent antimicrobial used in hand soaps and as a persistent treatment for durable goods such as countertops and clothing, has been used in several oral care toothpastes. This approach to oral biofilm management has as its underlying philosophy a belief in lowering the bacterial population in as thorough and indiscriminate manner as possible with a goal, as illusive and potentially harmful as it is, of rendering the mouth 'germ free'.

A more recent approach has been the incorporation of enzymes into oral care delivery products. These enzymes are chosen for their effects on the polymer-like bonds that link molecules of the plaque framework together. This approach has as its underlying philosophy a somewhat more enlightened belief that, although the oral environment can never be rendered germ free, with the clever use of chemistry we can mitigate one of the chief attachment tactics of the bacterial population so that less of it sticks around.

Emerging science is painting a picture of the oral biofilm that questions both of these approaches: in terms of effectiveness of the first approach and in terms of efficiency of the second approach. Furthermore, this same science points to a third way of dealing with the oral biofilm that is now being exploited through the work of CS Bioscience Inc.

Building on the work of P.D. Marsh (Leeds Dental Institute, Leeds, U.K.), D. Relman (Stanford University, Palo Alto, Calif.) and others, the emerging science views the oral biofilm as an ecosystem, with hundreds of species of microbiota, that functions as a collective with sophisticated methods of communication, nutrient uptake, waste removal, and defense. As these species-specific "collectives" have co-evolved with humans, they must, by the laws of evolution, convey and provide a distinct survival advantage to their host. As such this ecosystem, in its balanced state, serves as a benefit to its host, living symbiotically and contributing to the health and stability its niche, the oral cavity. In its balanced state, it has a low film thickness, is slick and non-sticky, and is non-odorous.

It is only when this ecosystem gets out of balance, out of homeostasis, that we witness signs of clinical disease. As it deteriorates, the collective, through quorum sensing, call for more of specific types of bacteria to come to the aid of the biofilm and begins to stack on top of the existing community, becoming thicker, stickier, and smelly. The unbalanced biofilm favors fermentation, anerobic metabolism, and free radical production. These processes produce tooth decay, gum disease and halitosis. Keeping the biofilm in balance prevents the biochemical cascades that lead to these outcomes.

Attempts to eliminate the biofilm are bound to lose effectiveness, as it has learned, through millennia, how to re-establish itself. Further, by disrupting it with antimicrobials, a mechanism for selective overgrowth of non-susceptible species is brought into play. As we have learned with MRSA infections, long term suppression of native microbial ecosystems carries a high cost.

An attempt to de-polymerize the biofilm via enzyme action recognizes the futility of the prior approach. But, by addressing the biofilm simply as a problem of 'sticky chemistry', it is bound to be, at best, an inefficient solution. This is because this approach ignores the evolutionary capacity of the collective to modulate its proteins and polymers in such a way as to create an even stickier biofilm in order to insure its survival.

Rather than treating the biofilm as an 'enemy'; rather than treating the biofilm as a problem of 'stickiness'; the emerging science points to recognizing that the biofilm has intelligence, useful functions, and plays a critical role in oral and systemic health - yet has a tendency to become unbalanced. By supplying key nutrients in specific ratios, the biofilm is aided in remaining in balance. In that state it is odor free, thin, of neutral or alkaline pH, rich in minerals that support healthy tooth structure, aerobic in metabolism, and protective, rather than injurious to the soft and hard tissues of the mouth. In such a state, the biofilm is not an enemy to be defeated, it is not an overly sticky goo; rather, living as it has for millennia, it is a symbiotic inhabitant of the oral cavity—capable of aiding in the processes of digestion, hard and soft tissue protection, and preservation of its niche—a healthy, clean, and comfortable mouth.