Can Proteins Cure Dental Cavities?

Teeth are subject to many glitches, most of which are caused by microorganisms. Regrettably, the state of medical technology when it comes to control of harmful microbes in the mouth, it lags, far behind in regulating the microbial populations in added situations and settings. It is equitably well understood how microorganisms cause periodontal diseases and dental caries, meaning which species are responsible and which mechanism is important but so far, no lasting strategy for removing unwanted oral microbes or blocking their activities has made a headway in laboratory or in clinical situations. Getting rid of microbes in the mouth is easy, but ensuring that only certain specific categories are detached, and also keeping them aloof for a few hours or days, has turned out to be far more stimulating.

Microorganisms break down sugar and other fermentable biological compounds in oral environments to acid, as a by-product, which can demineralize the dental enamel. Although tooth decay is relatively harmless in its initial stages, once the cavity progresses through the tooth's enamel, serious health concerns can arise. Good oral hygiene remains the best prevention. Taking inspiration from the body's own natural tooth-forming proteins, researchers came up with a way to repair the tooth enamel. They accomplished this by capturing the essence of amelogenin a protein crucial to forming the hard crown enamel to design amelogenin-derived peptides that biomineralize which are the active ingredient in the new technology. Researchers at the University of Washington have designed a convenient and natural product that uses proteins to rebuild tooth enamel and treat dental cavities.

Nonetheless, some promising avenues have emerged, even though they remain somewhere in the process of development. This is the case for methods of regrowth of tooth enamel. Back in 2010, a group of scientists demonstrated regeneration of cavities in mice by delivering a peptide known to encourage bone formation and that worked on enamel as well. That attempt was conceptually similar to far more recent research work initiated now, in which a different peptide is used to outgrowth enamel deposition. Researchers have designed a product that uses proteins to rebuild tooth enamel and treat dental caries. This can in theory rebuild teeth and cure cavities without today's costly and uncomfortable treatments. Remineralization guided by peptides is a healthy alternative to current dental health care. Peptide-enabled formulations claim to be simple and would be implemented in over-the-counter or clinical products. Cavities are more than just a nuisance. According to the World Health Organization, dental caries affects nearly every age group and they are accompanied by serious health concerns. In addition, direct and indirect costs of treating dental cavities and related diseases have been a huge economic burden for individuals and health-care systems.

"These peptides are proven to bind onto tooth surfaces and novice calcium and phosphate ions." The peptide-enabled technology allows the deposition of 10–50 µm of new enamel on the teeth after each use. Once fully developed, the technology can be used in toothpaste, gels, solutions, and composites as a safe alternative to existing dental procedures and treatments. The technology would enable people to rebuild and strengthen tooth enamel on a daily basis as part of a preventive dental care routine.

A long-standing practical challenge associated with demineralization related to dental caries is incorporating a functional mineral microlayer which is fully integrated into the molecular structure of the tooth in repairing damaged enamel. The study demonstrates that small peptide domains derived from native protein amelogenin can be utilized to construct a mineral layer on damaged human enamel *in vitro*. Six groups were prepared to carry out remineralization on artificially created lesions on enamel: (1) no treatment, (2) Ca2 + and PO43 only, (3) 1100 ppm fluoride, (4) 20,000 ppm F, (5) 1100 ppm F and peptide, and (6) peptide alone. While the 1100 ppm F sample (indicative of common F content of toothpaste for homecare) did not deliver F to the thinly deposited mineral layer, high F test sample (indicative of clinical varnish treatment) formed mainly CaF2 nanoparticles on the surface. Fluoride, however, was deposited in the presence of the peptide, which also formed a thin mineral layer which was partially crystallized as fluorapatite. Among the test groups, only the peptide-alone sample resulted in remineralization of fairly thick (10 µm) dense mineralized layer containing Hap mineral, resembling the structure of the healthy enamel. The newly formed mineralized layer exhibited integration with the underlying enamel as evident by cross-sectional imaging. The peptide-guided remineralization approach sets the foundation for the future development of biomimetic products and treatments for dental health care.

The peptide-enabled technology allows the deposition of 10–50 µm of new enamel on the teeth after each use. Once fully developed, the technology can be used in both private and public health settings, in biomimetic toothpaste, gels, solutions, and composites as a safe alternative to existing dental procedures and treatments. The technology enables people to rebuild and strengthen. This claim may breathe new life into the discredited theory that supplementing the diet with antioxidants can improve dental health.

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