

Size matters: Advancements in nanotechnology for the treatment of sensitivity

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One of the most common complaints dental hygiene patients express during routine visits is dentinal hypersensitivity, with studies indicating a prevalence of 11.5% to 33.5% in the US.¹

Why do so many individuals suffer from sensitivity? As with many conditions, it appears to be multifactorial. The most common culprit is loss of periodontium, caused by plaque, mechanical damage, or malocclusion.² Other reasons include dental attrition, erosion, fractures, abrasion, abfraction, or bruxism. When external elements such as cold, hot, or sweet foods and beverages penetrate the enamel and dentin, they disturb the delicate pulp tissue and cause pain and discomfort in the affected individual.

The most widely accepted at-home products for tooth sensitivity use the incorporation of calcium phosphate compounds, such as casein phosphopeptides-amorphous calcium phosphate (CPP-ACP), a milk-derived compound absorbed by the teeth, which transforms into apatite crystals.³ Other products combine nanohydroxyapatite (nHA), fluoride, and xylitol. These nanosized particles enter compromised enamel pores and form a protective coating.⁴ While CPP-ACP is a larger, bulk form of calcium phosphate that poses contraindications to users with milk allergies, nHA are smaller, well-defined, crystalline structures that yield more promising long-term results.

Although these products have helped patients with sensitivity and enamel demineralization, researchers recognize opportunities for further

improvement. After numerous developments and tests, calcium phosphate ion cluster (CPIC) technology is the latest advancement in treating dentinal hypersensitivity at the nanoparticle level. CPICs are even smaller than nHA and are precursors for hydroxyapatite (HA) crystals, the primary mineral in enamel. CPICs mimic the body's natural mineralization process, providing a more bioavailable and efficient source of minerals compared to existing technologies.

Human enamel features a hierarchical structure in which enamel rods form a “fish scale” pattern. In a recent study, CPICs accurately replicated this pattern

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within 48 hours after being applied to damaged enamel, a feat not achievable by conventional ACP nanoparticles. The enamel repaired by CPICs was confirmed by scanning electron microscopy (SEM) to accurately reconstruct the enamel from the nanoscale to the macroscale.⁵

Pac-Dent is proud to introduce ProMin F, an innovative desensitizing tooth cream incorporating CPIC, potassium nitrate, xylitol, and sodium fluoride. Once applied, the CPICs slowly release calcium and phosphate ions that penetrate microscopic pores and defects in the enamel and then form hydroxyapatite crystals that merge directly with existing enamel to promote regeneration



Image courtesy of Pac-Dent

and reduce hypersensitivities. Potassium nitrate boosts the desensitization effect of CPIC, while xylitol provides cariostatic protection. The fluoride in ProMin F accelerates the absorption of calcium and phosphate ions into the tooth structure for faster and more effective enamel repair. Fluoride also contributes to the formation of fluorapatite, a more acid-resistant variant of hydroxyapatite, improving enamel resistance to acid attacks from plaque and dietary sources. ProMin F can be applied by toothbrush, finger, or used in custom trays for extended wear. Nanotechnology is the way of the future, and with the help of CPIC technology, Pac-Dent is providing revolutionary relief for an age-old problem. **RDH**

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