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Nonsurgical Method for Restoring Tooth Enamel

IP Status: Issued US Patent; **Application #:** 15/674,901

Delivers supersaturated calcium phosphate directly to lesion

A noninvasive technology can treat tooth decay at its earliest sign through remineralization of tooth enamel. This technology combines two nonsurgical methods: polymer-induced liquid precursors (PILPs) and elastin-like recombinamers (ELRs). These methods deliver a void-filling organic substrate and supersaturated amorphous calcium phosphate (ACP) deep into the lesion.

Early stage lesions (e.g., white spot lesions): PILP is used to form a liquid-like amorphous calcium phosphate (ACP) that infiltrates into porous substrates and crystallizes to form hydroxyapatite nanocrystals. This process stops and reverses lesion progression.

Larger enamel defects (caries or erosion): a combination of PILP and ELRs is used. ELRs are used first to fill in large voids/gaps on the damaged enamel surface, and then the PILP process infiltrates ACP into the ELR matrices and the interstitial spaces between the enamel rods.

PILP and ELRs together quickly remineralize and restore enamel

Traditionally, dental caries are treated by removing affected enamel and replacing it with restorative materials while a “wait and see” approach is adopted for early lesions. This new technology treats lesioned teeth at first clinical sign, thus stopping lesion progression and helping to avoid tooth excavation. And while a few remineralization/regeneration products currently exist, they have had little success. These products use unstabilized calcium and phosphate ions to remineralize/prevent enamel lesions, but can be ineffective due to the shallow penetration of these ions. In contrast, this new technology offers a much deeper penetrating treatment. By delivering supersaturated liquid-like ACP directly to the target site, crystallization occurs below the surface of the tooth. In order to avoid the interference of saliva, the PILP solution is placed in a container/tray where the ACP can quickly remineralize enamel lesions. While PILP and ELRs have been used independently, this technology uniquely uses them together to remineralize and restore the structure, composition and mechanical properties, as well as aesthetic appearance, of intact enamel.

Phase of Development

- In Vitro assessment.

Benefits

- Treats tooth decay at its earliest clinical signs
- Helps prevent lesion progression
- Restores physical, mechanical, and aesthetic properties of carious and eroded tooth enamelt
- Mitigates the “wait and see” approach that leads to “drill and fill”
- Reducing the use of current porcelain veneers and composite resins

Technology ID
20160189

Category
Engineering & Physical Sciences/Chemicals
Engineering & Physical Sciences/Materials
Life Sciences/Human Health
Life Sciences/Pharmaceuticals
Agriculture & Veterinary/Veterinary Medicine

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Features

- Delivers supersaturated ACP deep into lesion
- Amorphous calcium phosphate crystallizes to form hydroxyapatite nanocrystals
- Combines polymer-induced liquid precursors (PILPs) and elastin-like recombinamers (ELRs) technologies
- PILP solution placed in container helps avoid interference of saliva

Applications

- Human teeth
- Restoring physical, mechanical, and aesthetic properties of tooth enamel
- Remineralization of enamel white spot lesions, damaged enamel and early caries
- Preventing progression of enamel caries

Researchers

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Publications

Biomimetic Mineralization of Recombinamer-Based Hydrogels toward Controlled Morphologies and High Mineral Density

ACS Appl. Mater. Interfaces, 2015, 7 (46), pp 25784–25792

Hybrid Nanotopographical Surfaces Obtained by Biomimetic Mineralization of Statherin Inspired Elastin Like Recombinamers

Adv. Healthcare Mater., 2014, 3, 1638–1647

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