New hope for regrowing worn-out tooth enamel

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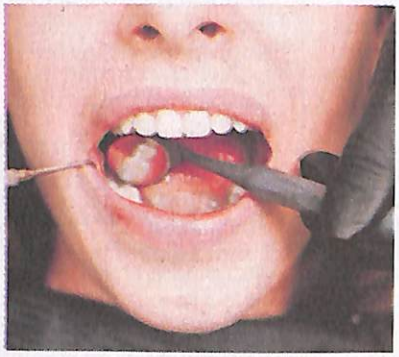
IN a major scientific breakthrough that is set to revolutionise dental treatment, researchers have developed a new technique to regrow human tooth enamel, the hardest substance in the body. The discovery offers hope to millions of people suffering from tooth sensitivity, erosion, decay and other conditions that were considered irreversible until now.

According to a study published in the international journal Nature Communications, scientists at the University of Nottingham's School of Pharmacy and Department of Chemical and Environmental Engineering have successfully restored both the structure and strength of damaged tooth enamel by using a protein-based bio-inspired substance that imitates the natural process through which enamel forms during childhood.

The researchers have designed a clinically-friendly supramolecular protein matrix using disordered elastin-like recombinamer (ELR) molecules to emulate key structural and functional features of the beta-rich fibrillar amelogenin matrix driving epitaxial and hierarchical mineralisation in dental enamel. They used both computational and experimental work to design the matrix and demonstrate the epitaxial growth of mineralised layers up to 10µm thickness from the surface of teeth exhibiting different levels of erosion. This gel-like substance, the researchers claimed, can restore damaged or eroded enamel, reinforce existing enamel and help guard against future decay.

Enamel, the outer covering of the teeth is the most mineralised and hardest part of the human body. It



shields from chewing pressure, temperature changes and acidic foods. Over time, enamel is gradually worn down by sugary and acidic diets, improper brushing, teeth grinding and ageing. Once enamel is lost, teeth become weak, sensitive and prone to cavities. As per the global estimates cited in the study, nearly half of the world's population suffers from oral diseases linked to enamel damage, costing the economy more than $500 billion every year. Current dental treatments like fillings, crowns and veneers can repair damage but they cannot restore natural enamel.

XPLAINER

Dr Ashok Kumar Jena, head of department of dentistry, AIIMS-Bhubaneswar, said the infection in the tooth is linked to many systemic diseases including diabetes, cardiovascular problems and poor pregnancy outcomes, underlining the importance of effective preventive dental care. As the enamel cannot be regenerated naturally once it is lost, dental care is always focused on its prevention and temporary protection" he said.

How it redevelops enamel

According to the study, this protein-based gel imitates the natural proteins responsible for guiding enamel formation early in life. But how does it regrow? The key to the technology lies in a process called epitaxial mineralisation, a highly controlled process in which new minerals grow in perfect alignment with existing tooth structures. It draws calcium and phosphate ions from saliva to encourage the precise growth of new minerals.

The researchers have extensively tested regenerated enamel under conditions designed to simulate everyday life, including tooth brushing, chewing, grinding and exposure to acidic foods and drinks. "When the newly developed material was applied to demineralised or eroded enamel, or to exposed dentine, it promoted the growth of crystals in an integrated and organised manner, recovering the architecture of natural healthy enamel," stated the study report. The fluoride-free gel, which contains no fluoride, can be quickly applied to teeth using the same method dentists use for traditional fluoride treatments. Once applied, it forms an ultra-thin but durable coating that penetrates the tooth surface, filling microscopic cracks and imperfections that form during enamel erosion.

"If this works safely in patients, it could change routine dental care by preventing early decay and reducing the need for fillings. While more clinical studies are needed, this research is a significant scientific breakthrough and may lead to simple, painless treatments to protect natural teeth in the future," Dr Pathak said.

Dr Jena, however, added that the results were purely based on lab research. "The real-life outcomes cannot be estimated solely from in-vitro experimentations. Further research and trials on several other aspects are required to ascertain whether it can actually transform oral health care."