New science

Dental enamel, composed almost entirely of the mineral hydroxyapatite, is the hardest substances in the human body.[1] As such, it is an effective barrier that protects the more sensitive layers of the tooth.

However, despite its incredible strength, enamel has only limited ways of regenerating itself once it has been damaged, through wear, acid attack or dental decay. The repair in the mouth is governed by the intricate balance of demineralisation through day to day challenges and the remineralisation by calcium and phosphates deposited by specialised salivary proteins.

This is a prevalent issue since, due to the nature of its composition, enamel is susceptible to almost constant demineralisation.[1] As we know, there are many different reasons for demineralisation, but by far the most important is the ingestion of fermentable carbohydrates. Sugars are, of course, the common culprits – particularly sucrose – and when these are introduced to the native bacteria of the mouth, lactic acid is formed, significantly lowering the intraoral pH and causing demineralisation,[1] and this may lead, if unchecked, to dental decay.

Fortunately, there are a number of things that can help prevent or, at least, slow the effects of demineralisation. Perhaps the most effective – and subsequently overlooked – is saliva. By regulating the pH levels in the mouth, saliva helps prevent enamel from decaying. There are also a number of artificial prevention and remineralisation therapies that can help maintain the desired intraoral equilibrium. The fluoridation of drinking water and toothpaste is, perhaps, the most recognised – and has demonstrable results, as it leads to the formation of fluorapatite, which is much more resistant to acid challenges.

Maintaining the equilibrium between demineralisation and remineralisation is one of the most important factors in preserving good oral health – and preventing dental caries. However, while it may be one of the most prevalent health issues in the world,[2] dental caries is still quite hard to detect, and particularly in its earliest stage, when remineralisation therapy can still repair the damage.

Fortunately, however, our understanding of dental caries has increased significantly over recent years and new technology is presenting itself that can aid dentists in early caries detection and subsequent treatment and prevention.

Cariologists have discovered that an effective way of detecting active demineralisation at its initial stage is to monitor a tooth's calcium components at a molecular level. For example, as demineralisation occurs, calcium ions are released from the crystalline structure of the enamel. These 'free' calcium ions then start to collect in solution in what are known as hydration shells – small pores and pockets that increase as the enamel's crystalline structure begins to

break down. Presence of free calcium ions is indicative of the progress or active status of demineralisation, providing a means to track the process at its earliest – and most reversible – stage.

This process is the basis of the innovative CALCIVIS imaging system. By introducing a unique and highly specific recombinant, luminescent photoprotein to the free calcium ions that are a result of active enamel demineralisation, a tiny flash of light – termed as a chemiluminescent signal – can be produced. This highly innovative technology has enabled CALCIVIS to develop a sensitive imaging device which produces a chair side map of active demineralisation, giving practitioners the necessary information to begin first-response preventive treatment before a cavity can form and more invasive treatments are required.

For more information visit www.calcivis.com, call on 0131 658 5152 or email at info@calcivis.com

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[1] Ross, M., Kaye, G., Pawlina, W. (2006) *Histology: a text and atlas*, 5th ed., Philadelphia; London; Lippincott Williams & Wilkins

[2] Vos, T. (2012) *Years lived with disability for 1160 sequelae of 289 diseases and injuries 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010*. 'Lancet' **380** (9859): 2163-96