How dental sensitivity can be improved with Biomin F

By Moira Crawford, UK

Sensitive teeth, causing discomfort and pain, particularly in reaction to hot or cold food and drinks, are a common problem. They are mainly affecting people aged 40-60, though sufferers can be of any age. Also known as dentine sensitivity, the condition is caused when the enamel surface of the tooth is worn away or damaged, exposing the dentine layer below. The dentine contains microscopic tubules, and hot or cold fluids trigger flow through the tubules, stimulating the exposed nerve endings in the pulp chamber, causing sensitivity. Sensitivity is most common at the margin where the tooth meets the gums, gum recession exposes the tubules, or it can be due to erosion where the enamel, which is very thin in this area, has been dissolved away by acid attack.

A wide variety of specialised toothpastes and products are available over the counter or on prescription for the treatment of dentine sensitivity, but a new solution has been found to the problem: a bioactive glass which acts with the saliva in the mouth to remineralize tooth enamel, occluding the dentinal tubules and effectively preventing sensitivity.

How BioMin F works

BioMin F is one of a new generation of bioactive glasses, which were initially introduced for bone grafting. These new glasses, incorporating other components within their structure, are now finding uses in the dental arena. BioMin F toothpaste has been developed by Professor Robert Hill and his team at the Dental Institute, Queen Mary University, London, and contains a bioactive glass which delivers a combination of calcium, phosphorate and fluoride ions as it dissolves. This combination promotes effective remineralization of tooth enamel through the production of fluorapatite, the fluoride analogue of natural tooth mineral. Unlike conventional toothpastes which contain soluble fluoride, the fluoride component of BioMin F is incorporated within the structure of the glass and so is delivered gradually over up to 12 hours as the glass dissolves.

As well its fluoride component, BioMin F contains a higher phosphate content than the previous generation of bioactive glasses, such as NovaMin, which form hydroxyapatite material in the mouth. The increased phosphate content of BioMin F aids both the effectiveness and the speed of remineralization, and as the calcium, phosphate and fluoride ions are released, these work in concert with the saliva in the mouth to restore equilibrium following acid attack, and form fluorapatite material, which is more stable and resistant to acid than hydroxyapatite.

Tests using an NMR spectrometer have demonstrated that the fluoride in BioMin F is converted to fluorapatite in around six hours in buffer, but as quickly as within 45 minutes in artificial saliva, and the remineralization process continues for around 12 hours, with residual activity for up to 24 hours. At a lower pH, following consumption of an acidic drink, for example, BioMin F dissolves more rapidly to restore the equilibrium and prevent demineralization.

Tubule occlusion

Importantly for the treatment of sensitivity, the glass needs to dissolve right on the tooth surface, so BioMin F contains a polymer which bonds it to the calcium in the tooth enamel, holding it in place for several hours while the calcium, phosphate and fluoride ions are released. The size of the glass particles is extremely small compared with those of NovaMin, enabling them to enter the dentinal tubules (1–5 microns across) and work to occlude them and prevent fluid flowing through them.

Fluorapatite forms preferentially on the apatite rich walls of the peritubular dentine within the tubules **(Fig. 1)** gradually filling and occluding them, an effect still visible after acid challenge **(Fig. 2)**. Professor Hill and his research team believe that fluorapatite crystals probably favour growing on the existing apatite rich surfaces within the dentinal tubules, which have a higher mineral content than elsewhere.

As the fluorapatite occludes the dentinal tubules, it reduces the flow of fluid through them, known as hydraulic conductance, the cause of sensitivity. Owing to the increased stability and resistance of fluorapatite, the tubules remain occluded more completely, and the hydraulic conductance shows a greater percentage reduction and faster remineralization rates than other toothpastes tested **(Fig. 3)**.

Importantly, patients appear to like it. A BioMin user survey in the UK, looking at patients who suffered from sensitivity, found that around 65% of them found their sensitivity had improved or even resolved, and almost half said it was more effective than other sensitivity toothpastes, while just under 40% found it roughly similar in effect. Overall 95% reported BioMin to be good or excellent, liking the texture, flavour, sense of cleanliness and level of foaming.

Crucially, though, rigorous testing in the state of the art laboratories at Queen Mary has shown that delivering this precise combination of calcium, phosphate and fluoride ions in the slow release format provided as the glass dissolves, forms an apatite material in the mouth which is not only quick to start occluding the dentinal tubules effectively, but continues to work over several hours and is stable and resistant to acid attack. Great news for sensitivity sufferers.

Visitors of the Dentistry Show will find more information about Biomin F at the Trycare booth (E40). There, Dr David Gillam, clinical adviser to BioMin and Senior Lecturer at QMUL will be also giving two short presentations on Dentine Hypersensitivity Management at 9:30 and 11:00 on Friday, 12 May. He will also hold a longer lecture in the Perio Lounge at 13:30 that day.

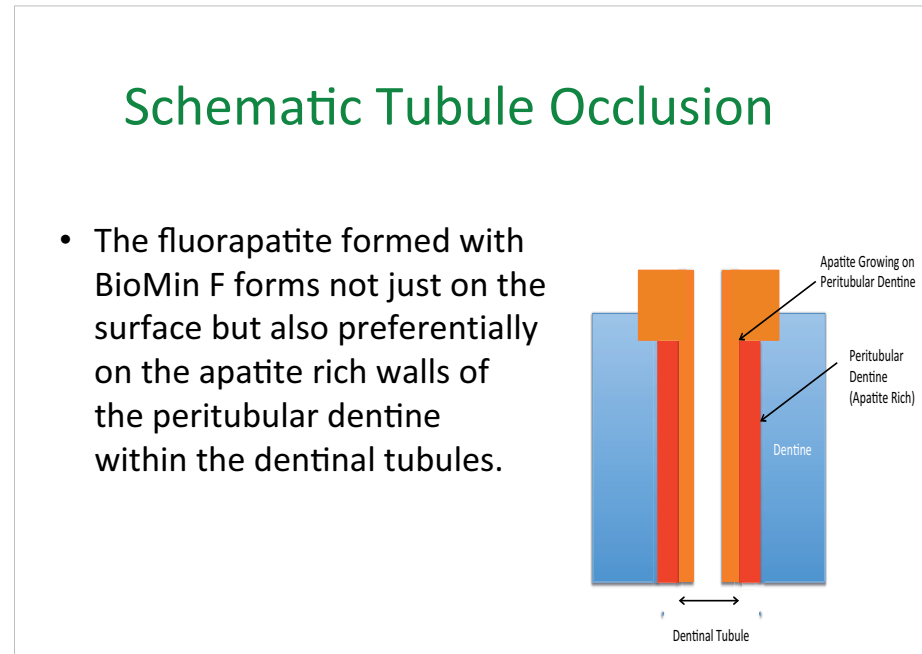

Fig. 1 : Schematic diagram of tubule occlusion.

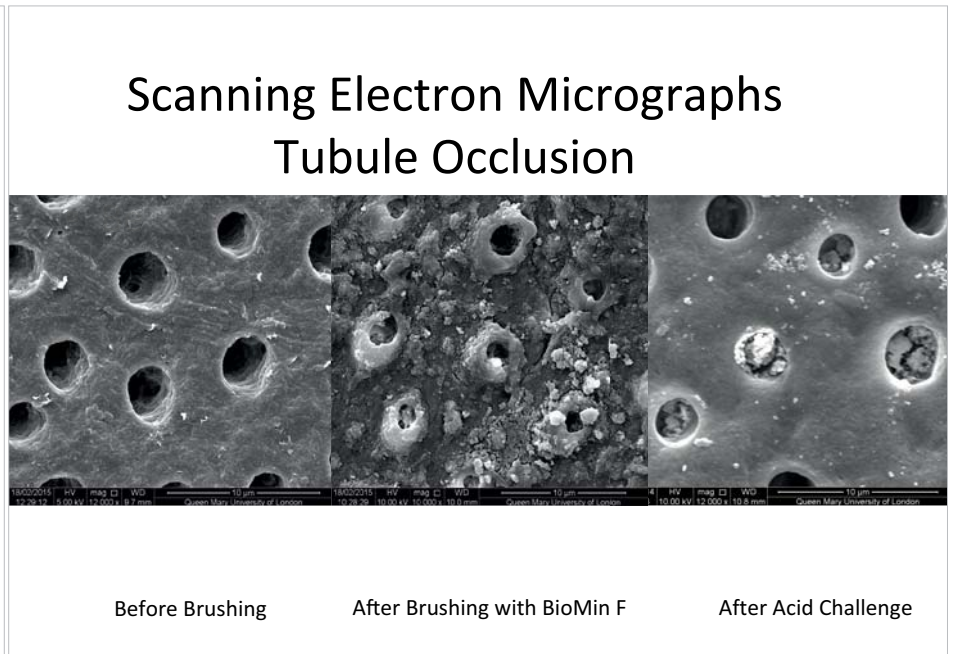

Fig. 2: Scanning electron micrograph images showing tubule occlusion before and after brushing and before and after acid challenge.

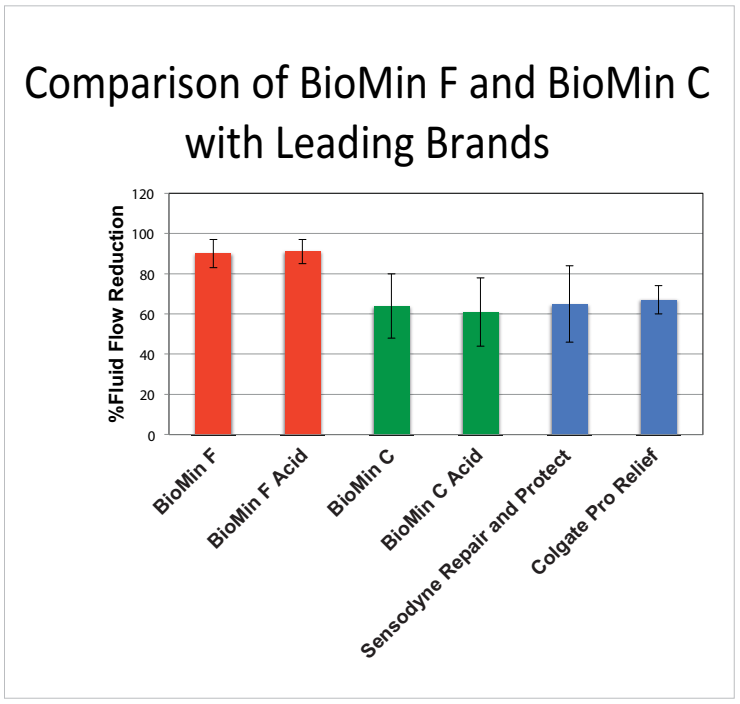

Fig. 3: Percentage fluid flow reduction compared with other toothpastes.

Moira Crawford
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