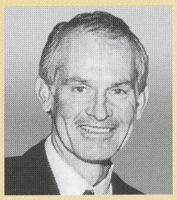
Co-ordinated by Geoffrey M Knight



The fissure seal dilemma

For many years, dentists have been less than comfortable with resin fissure sealing. In theory, the concept has a lot to offer. Biologically sealing the fissures of newly erupted teeth to prevent caries, especially in lower molars that seem to sit half erupted for so long accumulating plaque and (in a child) high carbohydrate food debris; is the ideal situation for caries to develop.

In reality, the experience of many practitioners has been quite disappointing. All too often patients have returned to a practice with large carious lesions beneath fissure seals often masked because the resin in the fissures has covered the caries underneath.

Enamel maturation

The biological soup in which dental enamel develops, results in the formation of apatite crystals that are contaminated with various metallic and carbonate ions as well as the calcium and phosphate (Fig 1).

After a tooth erupts, falls in pH below 5.5 in the oral environment will dissolve away the outer layers of the more soluble carbonated apatite crystals (Fig 2). If the saliva is rich in calcium and phosphate ions,

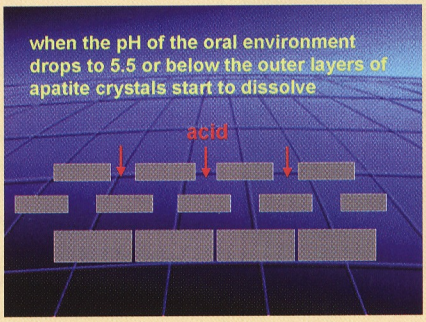


Fig. 2.

an outer shell of hydroxy apatite will form on the partially dissolved carbonated apatite surface replacing the metallic and carbonate ions (Fig 3).

If fluoride ions are also present in saliva, the fluoride ions will further replace the hydroxide ions in the hydroxy apatite to form fluor apatite (Fig 4). Enamel crystals formed of fluor apatite are best able to resist demineralization of the enamel surface from falls in pH due to any acidogenic bacterial activity in the surrounding environment.

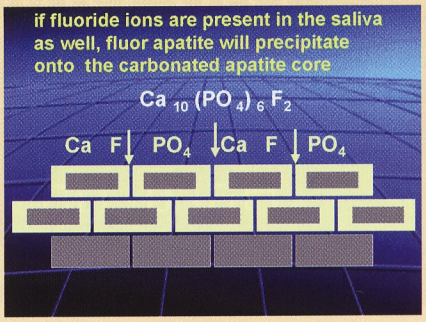


Fig. 4.

The resin fissure seal dilemma

When a freshly erupted tooth is fissure sealed with composite resin the carbonated enamel is isolated from the oral environment and the process of maturation from a carbonated apatite to a fluor apatite is prevented (Fig 5).

The outer layers of enamel in a fissure sealed tooth remain vulnerable to carious attack as soon as the fissure seal is removed or fails. A leaking fissure seal creates a difficult diagnostic problem as well as ▶

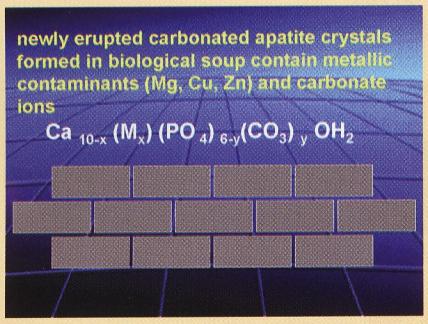


Fig. 1.

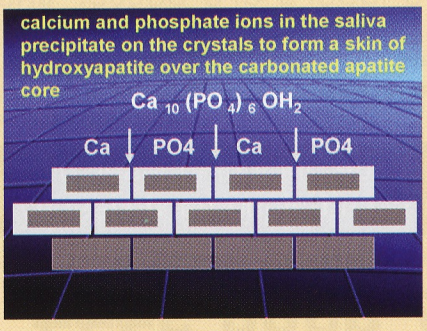


Fig. 3.

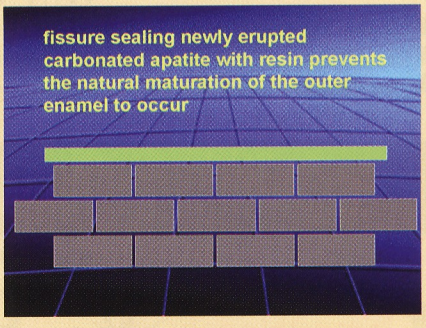


Fig. 5.

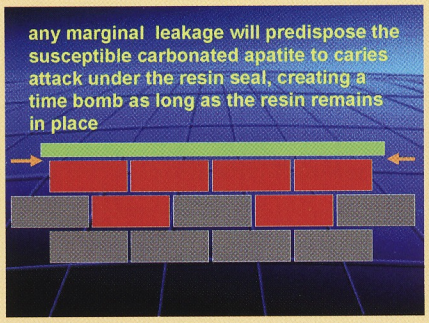


Fig. 6.

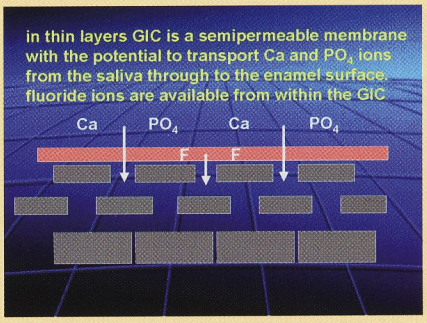


Fig. 8.

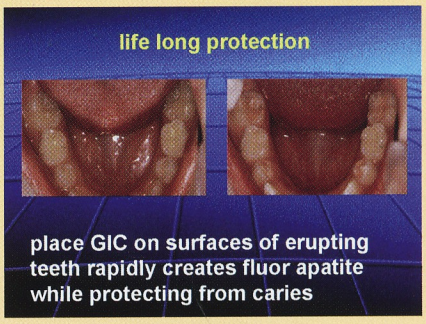


Fig. 10.

masking the advancing caries underneath (Fig 6).

An alternative solution

Dr Hien Ngo from the University of Adelaide has found that in thin layers, of half a milimetre or less, glass ionomer cement is a semi permeable membrane that enables the transport of calcium and phosphate ions from the saliva to the enamel surface below.

Furthermore, he has shown that when tooth enamel is placed in a demineralizing solution, the enamel protected by thin layers of glass ionomer will not demineralize as does the remaining enamel surfaces.

Slightly demineralizing the outer shell of the carbonated apatite crystals with phosphoric or polyacylic acid prior to placing GIC fissure protection primes these crystals for remineralization (Fig 7).

Applying thin layers of glass ionomer cement over the surfaces of newly erupted teeth not only protects the fissures but the entire surface from caries attack and at the same time enables calcium and phosphate ions to pass through it to the enamel underneath (Fig 8). Fluoride ions in the glass ionomer cement are also available to facilitate the formation of fluor apatite in the outer layers of enamel to further enhance surface protection from future fluctuations in pH that may predispose to the development of dental caries (Fig 9).

Practical application

Instead of applying a resin fissure seal, dentists have the option of applying a thin layer of a high fluoride release glass ionomer cement over the surfaces of newly erupting teeth.

Not only will this enable the normal maturation of the outer layers of enamel to occur but will predispose to the formation of fluor apatite instead of the normal hydroxy apatite, making the teeth even more resistant to future caries attack.

As the tooth erupts into occlusion, the glass ionomer cement on the occlusal surface will wear away so as not to interfere with development of the occlusal table. During the time it had been on the tooth, fluor apatite would have formed in the outer layers of enamel.

For the first time, it would appear dentists no longer have to rely upon parental compliance to apply topical fluoride to their children's teeth. Dentists may now be able to give children a 'one off' fluoride treatment that will protect their teeth from occlusal fissure caries throughout their lives (Fig 10). □

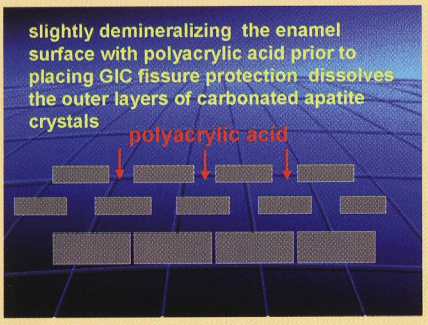


Fig. 7.

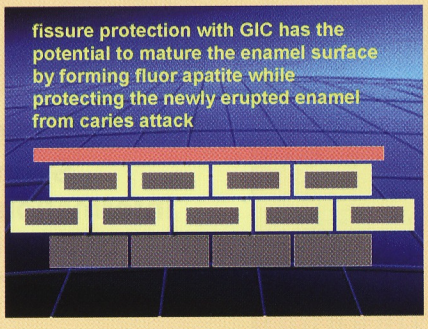


Fig. 9.