Chlorhexidine as an endodontic irrigant

Michael Sultan discusses using irrigants in endodontics

The most commonly used irrigant in endodontics is sodium hypochlorite. This is a highly alkaline disinfectant that can dissolve pulpal tissue and kill most of the bacteria found in infected root canal systems. However it is a highly caustic solution that can cause tissue damage, especially if forced into the periapical tissues, and can also damage instruments and clothes. Sodium hypochlorite has many undesirable side effects and an alternative is always being sought.

One of the causative agents in failure of root-filled teeth is Enterococcus faecalis, which is resistant to the alkaline solutions. Consequently, endodontists encourage the use of chlorhexidine not only as an endodontic irrigant but also as a final rinse to give long term protection to root canals before obturation.

Chlorhexidine itself is a chemical antiseptic that has been used at a low concentration of 0.2 per cent as a mouthwash for many years, primarily to reduce plaque and gingivitis. Prolonged use can cause marked tooth discoloration, as well as altered taste sensation. Higher concentrations have been used as a skin wash, although there are case reports of urticaria and contact dermatitis.

Chemically chlorhexidine is a cationic bisguanide which is highly lipophylic and interacts with cell membrane phospholipids and lipopolysaccharides and is consequently bactericidal. It is active against a wide spectrum of bacteria especially gram positives, less so on gram negatives and is also active against fungi. It has proved very effective against E. Faecalis which has proved resistant to sodium hypochlorite and calcium hydroxide and is found in failing root-filled teeth.

Much research has been done on the ideal concentration of chlorhexidine for use as an irrigant and the results are often conflicting. A few studies have shown 0.12 per cent Chlorhexidine (ie chlorhexidine mouthwash) as effective as 2.5 per cent sodium hypochlorite. As an anti bacterial the majority indicate that the optimal concentration is two per cent. At low concentrations it can take many hours to kill bacteria in a tooth. This can be shortened to minutes at a higher concentration.

Interestingly (for endodontists) chlorhexidine has a prolonged bacteriostatic action. This is an action termed ‘substantivity’. Following irrigation the chlorhexidine binds to surrounding tissues and has a slow release effect over an extended period. This can therefore in-
habit initial bacterial adherence and accumulation of biofilms, giving longer term immunity to bacterial leakage. Although this period is unknown, some research has indicated that a five minute rinse may give up to 12 weeks’ immunity. However other researchers think that this period is too short and suggest one week is required for dentine adsortion.

Further research has shown a synergistic effect when mixed with calcium hydroxide as an inter-appointed dressing and it is especially effective against E. Faecalis.

This all may appear to suggest that we should swap sodium hypochlorite for chlorhexidine. However there is always a downside.

Firstly not only is sodium hypochlorite very effective against most bacteria but it is also able to act as a tissue solvent, effectively disrupting and dissolving pulpal tissue which is ideal in those places our instruments cannot reach. It can also disrupt biofilms. Unfortunately, chlorhexidine has neither of these actions. Secondly, just like so-

dium hypochlorite, the tissue toxicity increases with higher concentrations. However, the effect of chlorhexidine can be increased by heating it in a similar fashion to sodium hypochlorite. There are also cost implications as sodium hypochlorite is very cheap and can be bought for 50p per litre, whereas although chlorhexidine mouthwash is cheap, the higher concentrations are very expensive and can retail at £5.00 for the same amount. Clearly it is impractical to swap the large volumes of bleach for chlorhexidine.

Most endodontists, therefore, use a combination of sodium hypochlorite and chlorhexidine to have a broad a kill as possible and to take advantage of the dissolution properties of sodium hypochlorite. However, when combined, an orange/brown precipitate of an insoluble neutral salt is formed. This precipitate, para-chloroalanine, is carcinogenic, can cause tooth discolorisation and can occlude dentinal tubules. The precipitate can be minimised by thoroughly drying the canal and using saline as a rinse between irrigants.

A suggested regime may be therefore to use sodium hypochlorite exclusively in all vital and hyperaemic canals.

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