RESEARCH SUMMARY

Photo-activated disinfection bacteria

An alternative regimen for root canal disinfection

S. J. Bonsor, R. Nichol, T. M. S. Reid and G. J. Pearson *Br Dent J* 2006; 201: 101–105

Objective
To compare the effect of a combination of 20% citric acid solution and photo-activated disinfection with the use of 20% citric acid and 2.25% sodium hypochlorite solutions on bacterial load on the dentine walls in prepared canals *in vivo*.

Subjects and methods
Sixty-four randomly selected cases were evaluated and allocated to one of two groups. In Group 1, after gaining access to the root canal, bacterial load on the canal walls was sampled using endodontic files. A further sample was taken after apex location and initial widening of the canal had been completed and the photo-activated disinfection process carried out. A final sample was taken after completion of the canal preparation using citric acid and sodium hypochlorite solutions. In Group 2, the initial sample was taken as described previously. A second sample was taken after conventional preparation using 20% citric acid and sodium hypochlorite solutions as co-irrigants. A final sample was then taken after a subsequent PAD treatment. All samples were cultured for facultative anaerobic bacteria.

Results
Of the canals treated in Group 1 only two of the 23 canals infected showed culturable bacteria after the use of citric acid and photo-activated disinfection. Of these two canals, one was free of culturable bacteria on completion of conventional treatment but the other still contained culturable bacteria. In Group 2, four canals of the 23 infected initially, remained contaminated after conventional treatment. After subsequent photo-activated disinfection three of these four canals were free of culturable bacteria.

Conclusion Results indicate that the use of a chelating agent acting as a cleaner and disrupter of the biofilm and photo-activated disinfection to kill bacteria is an effective alternative to the use of hypochlorite as a root canal cleaning system.

IN BRIEF

- Bacteria must be eliminated from the root canal system prior to obturation for endodontic treatment to be successful.
- Sodium hypochlorite solution is the most effective endodontic irrigant in current usage, but it is not effective against all the bacteria found in the root canal system.
- Photo-Activated Disinfection (PAD) offers the potential to effectively kill endodontic bacteria with fewer toxic effects and more quickly than with sodium hypochlorite solution.

COMMENT

In photo-activated disinfection (PAD) bacteria become photo-sensitised by absorbing a solution of tolonium chloride. The solution is activated by low power laser (635nm) light releasing active oxygen species causing disruption of the bacterial membranes.

This paper describes the application of PAD in endodontics. Patients requiring root canal treatment were divided into two groups. In both, crown-down pressure-less canal preparation was used but with different sequences of irrigant and photo-activated disinfection and the bacterial load was determined at three stages. In Group 1, there was initial coronal preparation using citric acid and sterile water as irrigants, then PAD. In Group 2, citric acid and NaOCl were used together and the canal fully prepared, then PAD was used. The root canals were sampled for aerobic bacteria: the sampling regime is not easy to follow because treatment of the canals was different between groups. The following table may help:

Bacterial sampling		
Occasion	**Group 1**	**Group 1**
First	Access	Access
Second	Apex location Initial canal widening only Citric acid + sterile water irrigants PAD treatment	Conventional canal prepn. Citric acid + NaOCl irrigants
Third	Completion of conventional prepn. Citric acid + NaOCl	PAD treatment

The Group 1 results demonstrated the efficacy of PAD in eliminating nearly all aerobic bacteria, where only sufficient coronal canal preparation was made to allow access for the light guide required to activate the photo-sensitising solution. Subsequent full canal preparation led a small further bacterial reduction. In Group 2, conventional p reparation accompanied by citric acid and NaOCl irrigation produced a similar reduction in bacterial load as in Group 1. Further treatment in Group 2 using PAD gave a small additional bacterial reduction. The reduction in bacterial load between the first and second samples was highly significant for both groups.

The results indicate potential for PAD in root canal disinfection of aerobic organisms. The study would have been clearer if sampling procedure 2 had been the same in both groups i.e. the canals initially enlarged coronally, treated with their respective irrigants and Group 1 treated with PAD. The report also hints at potential fragility of the light guide on the photo-activation equipment.

The investigator is to be commended for managing within primary care a complex clinical protocol. PAD has potential in root canal disinfection, one of the aims of endodontic treatment. It is hoped that the authors will continue their work.

R. Ibbetson, Director, Edinburgh Postgraduate Dental Institute, Chair of Primary Dental Care, University of Edinburgh.

DOI: 10.1038/sj.bdj.4813827