Editorial-2

Enterococcus faecalis: A Common Cause of Root Canal Failure

Endodontic treatment depends on identifying and eliminating the causative factors in the development of apical periodontitis so that optimal healing can be achieved. Bacteria and their byproducts play major role in the pathogenesis of apical periodontitis. Therefore, our prime objective is to eliminate bacteria and sources of nutrient supply from the root canal system.

Root canal failure is due to the survival of microorganisms in the apical portion of the root-filled tooth.[1,2] Unlike primary endodontic infections, which are polymicrobial in nature and dominated by Gram-negative anerobic rods, the microorganisms involved in secondary infections are composed of one or a few bacterial species.[2-5]

Enterococci are Gram-positive cocci, facultative anerobes, surviving very harsh environments including extreme alkaline pH (9.6) and salt concentrations. They can grow in the range of 10 to 45°C and survive a temperature of 60°C for 30 minutes.

Enterococcus faecalis is a persistent organism present in a small proportion of the flora in untreated canals playing a major role in the etiology of persistent periradicular lesions after root canal treatment.

Prevalence in Root Canal Infections

E. faecalis is a normal inhabitant of the oral cavity associated with different forms of periradicular disease. In the primary endodontic infections, *E. faecalis* is associated with asymptomatic chronic periradicular lesions. Found in 4 to 40% of primary endodontic infections, their frequency in persistent periradicular lesions is much higher. Furthermore, failed root canal treatment cases are nine times more likely to contain *E. faecalis* than primary endodontic infections.

E. faecalis overcomes the challenges of survival within the root canal system in several ways.

Antibacterial intracanal medication eliminates remaining bacteria after canal instrumentation and irrigation. Many medicaments have been used as intracanal dressings and according to their chemical basis, generally fall into the following categories: Phenolic derivatives (eugenol, camphorated paramonochlorophenol, camphorated phenol, metacresyl acetate, beechwood creosote), aldehydes (formocresol), halides (iodine-potassium iodide), calcium hydroxide, antibiotics and various combinations. The most popular intracanal medicament in use currently is calcium hydroxide.

Calcium hydroxide was proved to be ineffective at killing *E. faecalis* on its own, especially when a high pH is not maintained, this is due to the fact that at a pH of 11.5 or greater, *E. faecalis* is unable to survive. It is small enough to proficiently invade and live within dentinal tubules resisting intracanal dressings of calcium hydroxide for over 10 days. Able to form a biofilm, they resist destruction by enabling the bacteria to become 1000 times more resistant to phagocytosis, antibodies and antimicrobials than nonbiofilm producing organisms.[6-8]

Many studies have been directed toward finding an effective way to eradicate and/or prevent *E. faecalis* from gaining access to the root canal space. *E. faecalis* can gain entry into the root canal system during treatment, between appointments, or even after the treatment has been completed.

Chlorhexidine, in a 2% gel or liquid concentration, is effective at reducing or completely eliminating *E. faecalis* from the root canal space and dentinal tubules. A 2 minutes rinse of 2% chlorhexidine liquid can be used to remove *E. faecalis* from the superficial layers of dentinal tubules up to 100 µm.

When comparing 0.12% chlorhexidine to calcium hydroxide, some studies suggest it is more effective, yet neither will completely eradicate *E. faecalis*. Another study suggests 10% calcium hydroxide alone is more effective. When heated to 46°C, both 0.12% chlorhexidine and 10% calcium hydroxide have greater antimicrobial effects against *E. faecalis* than at normal body temperature.

Concentrations of 1 to 2% chlorhexidine combined with calcium hydroxide have also demonstrated efficacy at killing *E. faecalis*. It resulted in a greater ability to kill *E. faecalis* than calcium hydroxide mixed with water. Two percent chlorhexidine gel combined with calcium hydroxide achieves a pH of 12.8 and can completely eliminate *E. faecalis* within dentinal tubules.[9]

Chlorhexidine alone provided as good, or even better, antimicrobial action against *E. faecalis* than calcium hydroxide/chlorhexidine combinations.[10]

Until further studies are conducted, an intracanal dressing of 2% chlorhexidine placed for 7 days may be the best way to eradicate *E. faecalis* from dentinal tubules and the root canal space.[11]

In conclusion, *E. faecalis* possesses several virulence factors, it is able to cause periradicular disease stems from its ability to survive the effects of root canal treatment and persist as a pathogen in the root canals and dentinal tubules of teeth.

Since canals cannot be reliably rendered free of bacteria in 100% of cases, it is essential to reduce the microbial flora to as low a level as possible to ensure a successful outcome.

Our challenge as practitioners in the daily practice is to implement methods to effectively eliminate this microorganism during and after root canal treatment.

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