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Letter to the editor

Elimination of Enterococcus faecalis in the root canal during the SARS-CoV-2 pandemic

The SARS-CoV-2, first appeared in China in December 2019, is still a global health threat. This highly contagious virus even has the potential to escape immune response system due to the specific structure of its spike proteins. Therefore, during the SARS-CoV-2 pandemic, it is essential to provide an appropriate treatment plan for dental procedures to prevent the spread of the virus. Teledentistry, as part of telemedicine, can support remote primary dental care, decrease unnecessary referrals to dental clinics, and minimize the risk of cross-infection in the pandemic. Nevertheless, immediate therapy is required in the case of endodontic emergencies. Enterococcus (E.) faecalis is a major pathogen responsible for endodontic treatment failure.[1,2] This brief letter focuses on routine dental procedures in eliminating *E. faecalis* from infected root canals.

E. faecalis is an anaerobic Gram-positive bacterium well adapted to low oxygen levels and complex environments with nutrient deficiencies and high alkaline pH $\leq$ 11.5. *E. faecalis* is also capable of growing as a biofilm in the root canal without synergetic support from other bacteria and provides high resistance to antimicrobial agents in root canal treatment. This bacterium causes persistent intra or extra radicular infections and can attack into dentinal tubules.[2] Thus, eradicating *E. faecalis* is a priority in successful root canal treatment, especially during a pandemic.

In a laboratory study, Liu et al. evaluated three wave energies (i.e., 180, 280, and 360 mJ) of Nd:YAP laser against *E. faecalis* with NaOCl in 45 root canals. As a result, they found that using Nd:YAP laser at 280 mJ and 360 mJ with NaOCl in root canals can efficiently eliminate *E. faecalis* from the root canals and dentinal tubules.[3]

In another study, Goel et al. assessed the antimicrobial efficacy of 0.2% chitosan, 3% NaOCl, and 2% chlorhexidine (CHX) against *E. faecalis* alone or with a diode laser (810 nm) in 72 extracted teeth. The study found that *E. faecalis* is significantly reduced from the infected canals by 0.2% chitosan and 2% CHX. It has also been reported that using the diode alone does not provide satisfactory antimicrobial activity. Chitosan has the capability to disinfect the canals against *E. faecalis*. Therefore, activating the irrigation solutions, particularly chitosan with a diode laser (810 nm), is also recommended.[4]

In addition, Kushwah et al. evaluated the efficacy of 3% NaOCl, diode (980 nm), and ozonated water against *E. faecalis* in 120 extracted teeth. The results revealed that laser-activated ozonated water significantly eliminates *E. faecalis* from the canals. Therefore, applying a combination of ozonated water and diode laser (980 nm) is recommended to minimize the failure of root canal therapy.[5]

In line with the three previous studies, Yavagal et al. evaluated the efficacy of 2.5% NaOCl with and without Er:YAG (2940 nm) in eliminating *E. faecalis* from infected paediatric root canals. The result demonstrated that laser-activated NaOCl is capable of completely annihilating *E. faecalis* from the root canals.[6] In addition, by selecting the correct parameters and reducing the aerosol generation or smoke during laser irradiation, using lasers can significantly increase the success rate of dental therapy during the pandemic.[7]

The effectiveness of 2.5% NaOCl as a conventional method was evaluated against EndoVac and ultrasonic irrigation to eliminate *E. faecalis* in 48 extracted teeth. Based on the obtained results, using EndoVac with 2.5% NaOCl, as a true apical negative pressure irrigation system, is more effective in reducing the number of *E. faecalis* in canals.[8] Since EndoVac significantly eliminates *E. faecalis* in the root canals, it can be used as an alternative to laser irradiation.

To eradicate *E. faecalis* during root canal treatment, Beegam et al. evaluated the antimicrobial efficacy of *Elettaria cardamomum*, *Trachyspermum (T.) ammi*, and 5% NaOCl on two- and four-week-old *E. faecalis* biofilms in 40 extracted teeth. Rinsing with NaOCl and *T. ammi* showed complete elimination of *E. faecalis*. Thus, *T. ammi* oil can be used to eliminate *E. faecalis* biofilm as an alternative to NaOCl.[9]

In line with eradicating *E. faecalis* in dentinal tubules based on 190 teeth, another study reported complete

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elimination of the *E. faecalis* with the following pastes: 1) triple antibiotic paste (i.e., minocycline, ciprofloxacin, and metronidazole) at 10 mg mL^{-1} concentration, 2) modified triple antibiotic paste (i.e., amoxicillin, ciprofloxacin, and metronidazole) at 20 mg mL^{-1} concentration, and 3) double antibiotic paste (i.e., ciprofloxacin and metronidazole) at 20 mg mL^{-1} concentration. The study highlighted that calcium hydroxide is not effective against *E. faecalis*. Also, triple antibiotic paste with a lower concentration of 10 mg should be considered to eliminate *E. faecalis* from infected root canals.[10]

As root filling materials, epoxy resin-based sealer (e.g., AH Plus) and premixed bioceramic root canal sealer (TotalFill BC sealer) have shown satisfactory antibacterial efficacy against *E. faecalis*.[11] In light of the foregoing information in this letter, *E. faecalis* poses a major challenge in root canal therapy. In this regard, elimination of *E. faecalis* has been more satisfactory by the following procedures: 1) laser-activated irrigation (i.e., Nd:YAP at 280 and 380 mJ with NaOCl, diode (810 nm) with chitosan, diode (980 nm) with ozonated water, and Er:YAG (2940 nm) with NaOCl), 2) EndoVac system with NaOCl, 3) using *T. ammi* oil as a root canal irrigation solution, 4) triple antibiotic paste for root canal disinfection, and 5) AH Plus and BC sealers as root filling materials. In addition, laser-activated irrigation can be considered a revolutionary attempt to complete the disinfection of infected root canals. Thus, appropriate treatment procedures are required to optimize root canal treatment, particularly during the COVID-19 pandemic.

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