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Effect of ciprofloxacin and levofloxacin alone or in combination with N-acetylcysteine on biofilm-producing *Enterococcus faecalis*: Contaminated root canals of extracted human teeth

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Introduction: Biofilm producing-*Enterococcus faecalis* remains a major challenge in the disinfection of an infected root canal system. The aim of this *in vitro* study was to investigate the antibacterial effect of ciprofloxacin (CIP), levofloxacin (LEV) and their combination with N-acetylcysteine (NAC) in root canals infected with *E. faecalis* biofilms.

Methods: Ninety one single root teeth were prepared. The antimicrobial effectiveness of seven-day intra canal medication with increasing concentrations (MIC to 1000MIC) of calcium hydroxide (CaOH₂), CIP, LEV, CIP plus NAC (8 mg/ml) and LEV plus NAC was evaluated using the roots infected with *E. faecalis* for 30 days. Colony-forming unit (CFU) counting was performed. Biofilm formation and structural changes were monitored using scanning electron microscopy (SEM).

Results: All the chemotherapeutic agents were significantly more effective than CaOH₂ ($P < 0.05$). There was no significant difference between combined treatment with NAC and single antibiotic treatments ($P > 0.05$) except for LEV plus NAC which showed significantly higher reduction in CFU/ml than LEV at concentrations of 50 MIC and above ($P < 0.05$). The effectiveness of the antibiotics was significantly positively correlated with their concentrations ($r > 0.8$; $P = 0.000$). SEM examination confirmed the formation of mature biofilms and a complete accordance between reductions in CFU/ml and destruction of biofilm structures was found.

Conclusions: The local application of CIP and LEV and *in vitro* synergism of LEV and NAC led to more antimicrobial efficacy than CaOH₂ against *E. faecalis* biofilms in root canals of extracted human teeth.

Biography

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