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Investigation into the effect of sodium hypochlorite irrigant concentration delivered by a syringe on the rate of bacterial biofilm removal from the wall of a simulated root canal model

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Aim: Irrigation is a crucial step of successful root canal treatment. It has several important functions, including biofilms disruption. Sodium hypochlorite (NaOCl) is the most popular root canal irrigating solution amongst dentists. This study aimed primarily to develop a transparent root canal model to study in situ *Enterococcus faecalis* biofilm surface removal rate and remaining attached biofilm when using 5.25%, 2.5% NaOCl and water as irrigating solution for 60s.

Methodology: A total of thirty root canal models (n=10 per group) were manufactured using a 3D printing technique. Each models consisted of two longitudinal halves of an 18mm length simulated root canal with size #30 and taper 0.06. *E. faecalis* bio-films were grown on the apical 3mm for 10 days in Brain Heart Infusion broth. Biofilms were stained using crystal violet. The model halves were reassembled, attached to an apparatus and observed under a fluorescence microscope. Nine mL of NaOCl (5.25%, 2.5%) or water (control) were used for 60 seconds and images were captured every second using a camera. The residual biofilm percentages were measured using image analysis software.

Results: The difference in residual biofilm between 5.25% and 2.5% NaOCl groups was 3.3% (± 0.3) ($p=0.001$). The bio-film removal rate for 5.25% group was 0.6% s⁻¹ (± 0.02) ($p=0.001$). Whilst, it was 0.4% s⁻¹ (± 0.02) ($p=0.001$) for 2.5% group.

Conclusions: The proposed bio-film model provided a viable mean to investigate biofilm removal under microscopy. The concentration of NaOCl had an influence on the removal rate of biofilm.

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