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Reduction of Bacterial Loads in Dental Plaque by H₂O₂ Photolysis

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Objectives Hydroxyl radical, one of the reactive oxygen species, is generated from hydrogen peroxide (H₂O₂) under light irradiation (i.e., H₂O₂ photolysis). The hydroxyl radical has a strong oxidative power, which could be applicable to kill bacteria. Previously, we reported that H₂O₂ photolysis treatment could exert a bactericidal effect against planktonic bacteria and *in vitro* single/multi-species biofilms. Since this treatment aims to be a new adjunctive caries treatment, assessing the capability of H₂O₂ photolysis to reduce bacterial loads in dental plaque (i.e., *in vivo* biofilms) is essential. Thus, to identify the potential of H₂O₂ photolysis as the adjunctive caries treatment, the bactericidal effect against dental plaque collected from volunteers was investigated.

Methods Twelve healthy volunteers harboring cariogenic bacteria were recruited and wore a removable splint with hydroxyapatite discs for 5 days to collect biofilms. After the test period, the bactericidal assay of H₂O₂ photolysis was performed on formed biofilms. Then, suspensions of some treated biofilms were cultured, and viable bacteria were evaluated by colony counting. The proportion of cariogenic bacteria was also evaluated using quantitative real-time polymerase chain reaction (q-PCR). Volunteers wore the splint with discs containing treated biofilms for additional 5 days to observe the re-growth of biofilms after treatments. The protocol was approved by the Swedish Ethical Review Authority (Dnr 2021-03933).

Results The treatment with H₂O₂ photolysis showed about a 3-log reduction in total bacteria and total *Streptococci* compared to the control (i.e., no-treatment). On the other hand, there were no significant differences in the re-growth between treatments. Additionally, q-PCR analysis found that there were no significant differences regarding the proportion of cariogenic bacteria.

Conclusions This study demonstrated that H₂O₂ photolysis could work on *in vivo* biofilms. Although this is an ongoing study, the current results suggest that H₂O₂ photolysis has the potential as a new adjunctive caries treatment.