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The Photo-Activated Antibacterial Action of Toluidine Blue O in a Collagen Matrix and in Carious Dentine

J.A. Williams[a] G.J. Pearson[a] M.J. Colles[c] M. Wilson[b]

[a]Department of Biomaterials in relation to Dentistry, Queen Mary University of London, [b]Department of Microbiology, Eastman Dental Institute for Oral Health Care Science, University College London, London, [c]Denfotex Light Systems Ltd., Inverkeithing, UK

Abstract

The main aim of this study was to determine the susceptibility to photo-activated disinfection (PAD) of *Streptococcus mutans* when the organism was present in a collagen matrix – an environment similar to that which would exist within a carious tooth. In addition, the susceptibility to PAD of bacteria present in carious human teeth was also determined. Light was delivered to the collagen and teeth using a system comprising a 0.8-mm diameter isotropic tip emitting light at 633 ± 2 nm. A single concentration of TBO (10 μg/ml) was used with both collagen and dentine. Two contact times, 30 and 180 s, were evaluated in intact collagen and additionally, for 180 s only, in collagen partially disrupted by shredding. The effect of energy doses from 1.8 to 14.4 J on the kills attained was assessed by determining the number of surviving viable bacteria. In carious dentine, two contact times, 30 and 60 s and one energy dose, 4.8 J, were used. Antibacterial effects were less than those obtained using planktonic suspensions with a maximum mean log reduction of 1.4 in shredded collagen and dentine. Increasing contact time increased the antibacterial effectiveness in both substrates although this was not always of statistical significance. Shredding the collagen resulted in significantly increased bacterial kills compared to those obtained in intact collagen for the 30-second contact time. The collagen matrix appeared to be a suitable model for carious dentine with advantages of availability and reproducibility. The results of this study have shown that PAD can achieve appreciable kills of oral bacteria, including *S. mutans*, when the organisms are embedded in a collagen gel or are present in carious teeth.