The pharmacological management of dentine to protect against plaque microorganism degradation

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Abstract

Background

There is a transition towards minimally invasive restorative techniques in restorative dentistry based upon reducing bacterial viability and encouraging remineralization of caries infected tissue. To improve the predictability of the antibacterial and remineralization potential of carious dentine by either the application of medicaments or placement of restorative materials that encourage remineralization would be a significant benefit in disease management.

Materials and Methods

An experimental model was developed using a chemostat for *in vitro* analysis of the effects of silver fluoride followed by potassium iodide (AgF/KI) and ozone treatment on non demineralized and demineralized dentine.

Electron Probe Micro Analysis (EPMA) and Scanning Electron Microscopy (SEM) on the treated dentine were conducted to investigate ion transfer, and biofilm formation. Bacteria growth was measured by optical density.

IV

An *in vitro* caries model using a chemostat was developed to determine the ability of glass ionomer cement and composite resin to inhibit dentinal degradation in adjacent dentine and to measure ion exchange at the restorative interface.

Tests were made to determine the bond strength between dentine and glass ionomer cement after application of silver fluoride to the surface of the dentine.

Results

S. mutans migrated through all dentine samples. Samples treated with AgF/KI had significantly lower optical densities than the corresponding controls. Optical density readings were significantly lower in demineralized dentine treated with AgF/KI than non demineralized dentine.

There were lower but not significant differences in the optical density readings between ozonated and non ozonated dentine.

An *S. mutans* biofilm covered all control discs. No biofilm was detected on discs treated with AgF/KI and these discs were significantly more resistant to further demineralization than the control discs. Detectable amounts of silver and fluoride were found up to 450 μm in the AgF and AgF/KI sections.

V

Ozone infusion prevented *S. Mutans* and *L. acidophilus* biofilm formation on all the treated dentine samples, biofilm was present on all control specimens.

There was calcium and phosphorus present in all auto cure glass ionomer cements to a depth beyond 50 microns. Aluminium and strontium ions were also present in dentine except strontium subjacent to Ketac Molar restorations.

Fluoride uptake was significantly higher under glass ionomer cement restorations where the dentine was pretreated with AgF/KI compared to non treated specimens. Silver and iodine deposits were present in demineralized dentine treated with AgF/KI.

Calcium and phosphorus levels up to 130 microns from the restorative interface were similar to non demineralized dentine adjacent to auto cure glass ionomer cements and half that adjacent to composite resin. There was significant surface degradation in auto cure glass ionomer cements compared to composite resin.

Washing away the AgF/KI precipitate produced higher bond strengths to dentine than samples where the precipitate remained.

VI

Conclusions

Under the conditions of these *in vitro* studies, the application of AgF/KI and ozone pharmacologically reduces the initiation and rate of dentine caries.

Glass ionomer cements were shown to protect dentine from experimental carious degradation and assist with remineralization. AgF/KI application enhances remineralization beneath glass ionomers and does not interfere with bond strengths.

Statements of Originality and Authorship

Statement of Originality

This work contains no material that has been accepted for the award of any other degree or diploma in any university or tertiary institution, and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

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Geoffrey M. Knight dated

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Disclosure

The candidate was associated with the development of Fuji VII restorative material (GC Corporation, Tokyo, Japan) and has a financial interest in this product. Authors Knight and Craig are jointly named on a process patent associated with the use of silver fluoride and potassium iodide.

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