SUSCEPTIBILITY OF SEVERAL TOOTH-COLOURED DENTAL MATERIALS TO EROSION

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ABSTRACT

Introduction

Substances like gastric acid (HCl), citric and phosphoric acids are well known for their ability to cause dental erosion. The current popularity and consumption of acidic drinks is considered highly likely to contribute to the increasing incidence of tooth wear problems. Several restorative materials have been considered as being appropriate for restoring these defects, especially tooth-colored dental materials. Whether these erosive substances may simultaneously etch the surfaces of the teeth and the glass-based restorations is not known. The objective of this study is to determine whether such materials sustain damage from the erosive acidic solutions.

Materials and Methods

The materials tested were those representative of the Conventional Glass Ionomer Cements (GICs) (Fuji IX Fast, Ketac Fil Plus), of the Resin Modified GICs (RMGICs) (Fuji II LC), of the Composite Resins (Z 100), and porcelain. The direct materials were initially placed as restorations in the crowns of human teeth, and the surfaces of the teeth painted with nail varnish to within two mm of the restoration. Defined equivalent surface areas of the porcelain crowns were marked using nail varnish protection of adjacent areas.

The initial investigations were into the surface erosive effects of 0.06M (0.113%) HCl, 5% citric acid and 0.02% phosphoric acid, following differing time periods of exposure, on the above materials *in vitro*. SEM analysis was mainly used to determine the comparative effects of the chemicals on the surface structure of the materials. The depth of etching of the adjacent tooth structure was measured using a Leica stereomicroscope (Germany).

Subsequent tests were directed to find how far the erosive solutions affected the chemical composition of the materials, using Electron Probe Micro-Analysis (EPMA). Bar charts were plotted to determine the concentrations of fluoride, aluminium, phosphorous and strontium at three different distances from the surface (0-50 micron, 51-100 micron and 101-150 micron depths)

Results

Marked etching effects are seen with glass-ionomer materials when compared with composite resin, which showed minimal changes. Citric acid and hydrochloric acid caused the most erosive effects and phosphoric acid was the least erosive at the concentrations tested using this *in vitro* model. Porcelain didn't show any surface changes even following four weeks immersion in the erosive solutions.

Marked loss of material was observed and quantitated using stereoscopic methods, particularly when the Conventional GICs were challenged with citric acid and hydrochloric acid. Only the RMGIC demonstrated superficial surface loss of structural elements as seen using EPMA following challenge with these acids, though dissolution of surface material also occurred with the conventional GICs.

Conclusions

The traditional GICs experienced the most severe erosion on exposure to simulated gastric acids and citric acid, at concentrations frequently experienced in the mouth, with bulk loss resulting with increasing time of exposure. The RMGIC showed much less damage to these acids. No discernable effects of these acids were seen on dental porcelain and quartz based composite resin restorations even after prolonged exposure. Phosphoric acid at this concentration did not have any major erosive effect on any of the restorations. The effect of citric acid was shown more at the margin of the conventional glass-ionomer cements than in the body of the restoration.