Effect of pH on Strength and Fluoride Release of GICs

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Introduction

Glass ionomer cements (GICs) are dental restorative materials under constant development[1]. One important property of these restoratives is to function as a (rechargeable) fluoride reservoir. The fluoride released from GICs is assumed to reduce the formation of secondary caries. Several studies confirm fluoride release from these materials, but there is limited knowledge of the effect of pH on the release of fluoride. In addition, it is unclear if the pH in the surroundings of a GIC restoration affects the mechanical properties of the material.

Objectives

The purpose of this study was to evaluate the effect of pH on the strength and fluoride release from glass ionomer cement.

Methods

The GIC tested was a self-setting product (GC Fuji IX GP Extra). The specimens for three-point bending test (2x2x25) mm were made in molds after mixing according to the instructions. After curing (24h at 37°C, 100% RH) the specimens were placed in borosilicate tubes containing 4ml of 1mM TRIS-buffer solution at pH 4, 6 and 7 for 7 days (Figure 1). Thereafter, the specimens were tested in a three-point deflection jig (Lloyd LRX 2500N) at a speed of 0.75 mm/min (Figure 2). The concentration of fluoride in the solutions was measured for the TRIS-buffer solutions (Meter Lab 10N450 ion analyser) (Figure 3).

Results

Although a slight decrease in the mean flexural strength values was observed with decreasing pH, the differences were not statistically significant ($p \geq 0.5$) (Figure 4). Fluoride release was higher in buffer with lower pH; 17 µg/cm^2, 25 µg/cm^2 and 33 µg/cm^2 for solutions with pH values of 7, 6 and 4, respectively. The difference between the fluoride content between the solutions with pH 7 and pH 4 was statistically significant ($p < 0.05$) (Figure 5). In vitro studies have shown the ability of the glass ionomer restorations to inhibit enamel and dentin demineralization when exposed to acidic gels or demineralizing buffer solutions[2].

Keywords

GIC, Strength, pH, Fluoride

Figure 1: GIC exposed to solutions with different pH-values for 7 days at 37°C.

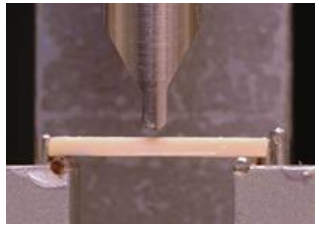

Figure 2: GI-specimen in three-point bending test.

Figure 3: Fluoride measurement equipment.

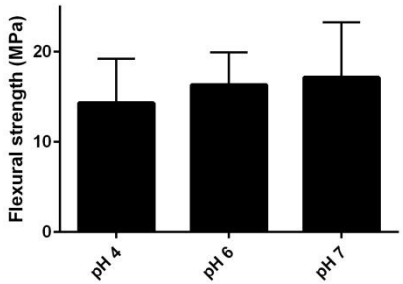

Figure 4: Flexural strength GC Fuji IX GP Extra.

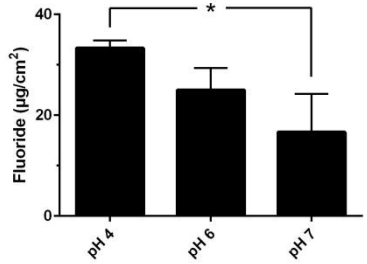

Figure 5: Fluoride realease after different pH exposure. Statistically significant ($p < 0.05$) between the solutions with pH 7 and pH 4.

Conclusions

- Different pH did not significantly influence the mechanical strength during the time span of this study
- The fluoride release from GIC increased at lower pH of the immersion buffer

References

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