

Effect of Fluoride-containing Mouthrinses on the Translucence of Resin Modified Glass Ionomer Cements

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The aim of this *in vitro* study was to assess the effect of different fluoride-containing mouthrinses on the translucence of resin-modified glass ionomer cements, as a function of the restorative material used, the fluoride-containing solution employed and the time of immersion. Disks were prepared (10 mm × 2 mm) with the modified glass ionomer cements Vitremer (3M) and Fuji II LC (GC Co.), and immersed in three fluoride-containing solutions: Fluordent Reach (Johnson & Johnson), Fluorgard (Colgate-Palmolive) and Oral B (Gillette do Brasil Ltda). Translucence was measured with electrophoresis equipment (JOUAN) after different immersion times. The results obtained were submitted to ANOVA and Tukey's test, and a statistically significant decrease was observed in the translucence of the materials after immersion in the fluoride-containing solutions. Fuji II LC demonstrated the lowest alteration in translucence, independently of the solution employed. Fluorgard was the fluoride-containing mouthrinse that promoted the highest alteration. It can be concluded that the fluoride-containing mouthrinses influenced the translucence of the resin-modified glass ionomer cements.

Keywords: *translucence, resin modified glass ionomer cement, fluoride-containing mouthrinses*

1. Introduction

From the understanding of the dynamics of the carious process, it was possible to observe that lesions originating from demineralization of the dental surface could develop into cavities, stay static or remineralize, the remineralized surfaces being more resistant to demineralization than the sound ones^{1,2}.

For a more effective remineralization process, it is necessary to control the bacterial biofilm and maintain a constant presence of fluoride in the oral cavity using 0.05% fluoride-containing solutions for daily domestic use. This

method is one of the most efficient and widely employed manners for controlling these conditions³⁻⁵.

According to the caries risk, the use of fluoride-containing solutions becomes a practical option for remineralization treatment. However, the routine use of such products can interfere or even alter the properties of some esthetic restorative materials, such as glass ionomer cements, compomers and composite resins⁶⁻⁸.

The composition of the esthetic restorative materials and the shape of their external surface may lead to the absorption of liquids and dyes, and consequently to staining⁹⁻¹¹.

However, the influence of available fluoride-containing

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solutions and gels on the optical properties of the esthetic restorative materials and consequently on the final esthetical results has, as yet, not been thoroughly studied, and more research is necessary to elucidate these influences and to allow the safe association of remineralization and esthetics, without risks for the restoration^{6,9,12}.

The present work aimed to assess the effect of fluoride-containing mouthrinses on the translucence of resin-modified glass ionomer cements, as a function of the restorative material, the fluoride-containing solution employed and the time of immersion.

2. Material and Method

Two resin-modified glass ionomer cements - Vitremer (M1) and Fuji II LC (M2) - and three 0.05% fluoride-containing mouthrinses - Fluordent Reach (S1)-green, Fluorgard (S2)-red and Oral B (S3)-blue were tested (Table 1). Thirty samples were prepared using a stainless steel matrix of 10 mm in diameter and 2 mm thickness, and were randomly assigned into 6 groups, which represented each experimental condition. The materials were proportioned and manipulated according to the manufacturers' instructions, so that their general properties were not affected, and inserted inside the rings placed on a glass plate under a weight of 1000 g for 1 min, with a uniform flow of the material. After light curing for 40 s (XL 3000, 3M Dental Products, St Paul, MN 55144), the samples were removed from the rings and placed in an isolating container with cold water for 1 hour, to obtain 100% relative humidity^{8,10,11,13,14}.

The specimens were immersed for 28 days in solutions and the measurement were realized in different time period. The first translucence measurement (T1-control) was made 1 h after the preparation of the sample maintained in 100% relative humidity in the others were realized after one hour of immersion in the fluoride-containing solutions (T2),

after 12 (T3), 24 (T4) and 48 h (T5), one (T6), two (T7), three (T8), four weeks (T9) immersion^{10,11,13}. The specimens were maintained in the respective solutions at $37\text{ }^{\circ}\text{C} \pm 1$ in a stove until the accomplishment of the readings.

The translucence measurements (in percentages) were accomplished using an electrophoresis equipment (Jouan-Paris-series 021 A/No.10), which emits a luminous radiation that surpasses the samples. The light is transmitted to a galvanometer, which registers the value in a scale from 0 to 100, indicating the percentage of light that activated the photoelectric cell, and providing the translucence percentile of the material^{8,10,11,13,14}. Before each reading, the specimens were washed in running distilled water for one minute and dried with absorbent paper.

The results obtained were analysed using three approaches (material, time and solution) by ANOVA, one of these approaches being linked. To distinguish the averages of the different groups and their interactions, the Tukey's test was used ($p < 0.05$).

3. Results

In comparison of materials independent of solutions and time period was observed that Fuji II LC - M2 ($44.80\% \pm 4.09\%$) presented the highest rate of translucence, being statistically significant different ($p < 0.01$) from Vitremer - M1 ($41.22\% \pm 6.44\%$).

In relation to the solutions, Fluorgard - S2 ($40.67\% \pm 6.81\%$) was the one, which most influenced the translucence of the tested materials, presenting significant difference ($p < 0.01$) when compared with the other solutions (S1 - $43.51\% \pm 4.57\%$ and S3 - $44.85\% \pm 4.33\%$). Independent of the time of immersion, the solutions promoted a significant alteration ($p < 0.01$) in the translucence of the materials (Fig. 1).

The interaction among materials, solutions and times of

Table 1. Materials tested.

Materials	Batch Number	Manufacturer	Composition
Fluordent Reach (S1)	02 - 4/2000	Johnson & Johnson, São José dos Campos, Brazil	0.05% Sodium fluoride and 5.6% alcohol
Fluorgard (S2)	10 - 4/2000	Colgate-Palmolive	Phosphoric acid and 0.05% Sodium fluoride
Oral B (S3)	T - 273 - 1	Gillette do Brasil Ltda, Manaus, Brazil	0.05% Sodium fluoride, chloride and sodium benzoate
Vitremer (M1)	3303MP-13	3M Dental Products, St Paul, MN	Resin modified glass ionomer cement
Fuji II LC (M2)	438031	GC America Inc. USA	Resin modified glass ionomer cement

immersion showed that there was a decrease in the translucence for all the interactions studied at time 1 (control), in comparison to the other times analysed. However, a statistical similarity was observed for different solution for Fuji II LC (M2). In relation to the time of immersion, it was observed that M1S2T2 and M1S3T2 demonstrated a significant decrease in translucence ($p < 0.05$) in comparison to T1. Fuji II LC (M2) did not suffer any alteration in translucence when Oral B (S3) was employed and as a result all the times presented statistical similarity. Conversely, when Fluordent Reach (S1) was used, significant alterations in the translucence occurred after just 24 h of immersion.

Vitremer (M1) demonstrated a decrease in the translucence when the three solutions were employed, being most affected by Fluorgard (S2), independent of the time of immersion. Fluordent Reach (S1) was the product which less affected the translucence of this material, only altering it after 12 h of immersion, and being statistically significant ($p < 0.05$) (Table 2).

4. Discussion

The use of fluoride-containing solutions and restorative materials with anticariogenic properties are suitable for the

control of caries disease; however, the daily use of mouthrinses can interfere in the esthetical properties of the restorative materials, such as translucence.

Alcohol is usually added to the composition of mouthrinses, in addition to the presence of other ingredients such as detergents, emulsifiers, organic acids, dyes and solvents, which can produce physical changes in the polymers, and consequently lead to superficial deterioration¹⁶.

The dyes in the solutions can also lead to pigmentation and affect the translucence of the material, increasing its opacity¹⁵. Thus, dental professionals should be attentive when indicating dyes-containing mouthrinses, in order to avoid interference in the longevity of esthetical restorations.

In the present study, it was observed that the fluoride-containing mouthrinse, Fluorgard, promoted a higher alteration in the translucence of the glass ionomer cements. Catirse *et al.*^{8,14} analyzed the influence of fluoride-containing mouthrinses on the translucence of polyacid-modified composite resins and conventional glass ionomer cement, and observed that Fluorgard promoted a higher rate of pigmentation in the tested materials. By analyzing the composition of Fluorgard, the presence of phosphoric acid and a solution with an acidic pH was observed, which may have provided a higher superficial alteration.

In the present study, Fuji II LC presented a lower alteration in the translucence, independently of the solution used, this occurrence could be explained by the difference in the composition of the materials, which can result in different performances. Cehreli *et al.*¹⁷ verified the surface roughness of esthetic materials that were submitted to topical application of acidulated phosphate fluoride and observed that Vitremer presented the highest rate of surface roughness after treatment with fluoride, which can promote a decrease in the translucence. The analysis of the composition and the cure mechanism of the two tested materials showed that Fuji II LC presents a different light-cure reac-

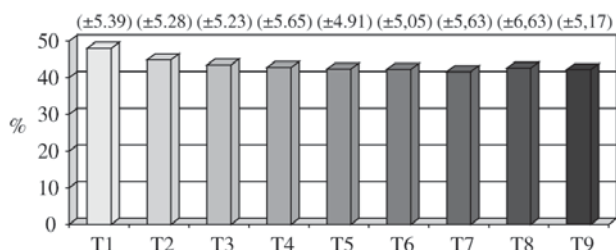


Figure 1. Translucence means (%) and standard deviation for the time factor independent of material and solution.

Table 2. Means and standard deviation (%) in different groups studied.

	M1S1 (sd)	M1S2 (sd)	M1S3(sd)	M2S1(sd)	M2S2(sd)	M2S3(sd)
T1	48 (±4)	45 (±10)	50 (±5)	48 (±4)	48 (±2)	48 (±5)
T2	44 (±4)	40 (±8)	45 (±4)	47 (±5)	47 (±2)	46 (±5)
T3	44 (±4)	39 (±8)	41 (±4)	46 (±4)	45 (±2)	46 (±4)
T4	43 (±6)	37 (±8)	43 (±3)	45 (±4)	44 (±3)	46 (±4)
T5	42 (±4)	39 (±7)	43 (±5)	43 (±4)	42 (±4)	46 (±3)
T6	41 (±3)	40 (±9)	44 (±3)	41 (±5)	42 (±2)	46 (±4)
T7	41 (±5)	37 (±9)	44 (±5)	41 (±4)	40 (±3)	47 (±3)
T8	41 (±3)	36 (±8)	44 (±4)	44 (±5)	43 (±3)	47 (±4)
T9	41 (±4)	38 (±9)	43 (±5)	43 (±5)	43 (±3)	45 (±3)

The lines showed statistical similarity.

tion from Vitremer. The resin-modified glass ionomer cements present a great variation in the size and distribution of particles. Vitremer has variable quantities of equally distributed small and large particles, whilst Fuji II LC presents a greater amount of large particles and a smaller number of small particles, providing a superficial characterization which is probably less affected by substances that cause deterioration¹⁸.

Composite resins can also present some superficial alteration under the action of fluoride-containing solutions; however, they will not necessarily provide similar effects in both types of materials, due to different formulations and performances, as demonstrated by Friedrichi *et al.*¹⁹.

The fluoride-containing mouthrinse which demonstrated the least influence on the translucence of the tested materials was Oral B, an observation also made by Friedrichi *et al.*¹⁹, Catisse *et al.*⁸ and Catisse *et al.*¹⁴ using other esthetic materials, and this fact can probably be explained by the absence of acid and alcoholic solutions in its composition.

The translucence of esthetic restorative materials suffers alteration even under the absence of dyes, mainly after 24 h, causing a gradual decrease with time^{8-10,14,19,20}, but to a smaller extent than that demonstrated in the present study.

According to the results obtained, it may be suggested that when restorations with resin-modified glass ionomer cements in esthetically-involved areas are indicated, and daily use of fluoride-containing mouthrinses are necessary, the glass ionomer cement Fuji II LC associated with 0.05% sodium fluoride solution without acid or alcohol (such as Oral B) should be recommended.

Clinically, small alterations in translucence would probably not affect esthetics of the materials in the studied period, but Fluorgard could affect sensibly the translucence, mainly of Vitremer. However, further studies about how the solutions would affect these materials in a longer period of time are necessary.

5. Conclusions

It may be concluded that, when the materials tested were immersed in the fluoride-containing mouthrinses, a significant decrease occurred in the translucence, independently of the time period. The resin-modified glass ionomer cement, Fuji II LC, demonstrated the lowest alteration in the translucence a part of the solution used, and Oral B presented the smallest influence on the final optical properties of the tested materials.

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