# SURFACE PROTECTION OF GLASS IONOMER CEMENTS

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**RESUMO**

*No presente estudo procedeu-se à avaliação da eficácia de três agentes de protecção de superfície, em dois cimentos ionómeros de vidro convencionais e num ionómero de vidro modificado com resina. Foram utilizadas 120 amostras (com 4,5mm de diâmetro e 2mm de espessura) fabricadas com Vidrion R (VD), Chelon-Fil (CH) e Vitremer (VT). Para cada ionómero de vidro, as amostras foram divididas em quatro grupos. Num grupo as amostras não foram protegidas - controlo positivo. Nos restantes grupos a superfície das amostras foi protegida com Fortify (FO), Finishing Gloss (FI) e verniz para unhas transparente - Colorama (CO). As amostras foram imersas em corante de azul de metileno a 0,05%, durante 24 horas. De seguida foram lavadas e imersas individualmente e 2 ml de ácido nítrico a 65% durante 24 horas. Os níveis de absorção de corante foram determinados por análise de absorvância num espectrómetro. Os resultados médios em cada grupo foram comparados estatisticamente com ANOVA e Teste de Tukey. Os melhores resultados foram obtidos pelo Finishing Gloss e pelo verniz para unhas - Colorama. Todos os cimentos testados devem ser protegidos durante o estadio inicial de presa.*

**Palavras-chave**: cimento de ionómero de vidro, absorção de corante, agentes de protecção de superfície

**ABSTRACT**

*The present study evaluated the effectiveness of three coating agents for the surface protection of two conventional and one resin-modified glass ionomer cements. One hundred and twenty specimens (4.5 mm diameter and 2 mm thick) were made with Vidrion R (VD), Chelon-Fil (CH) and Vitremer (VT) and divided into four groups. Positive control samples were not protected, while experimental samples were protected with Fortify (FO), Finishing Gloss (FI) or Colorama clear nail varnish (CO). The specimens were immersed in 0.05% methylene blue for 24 hours, subsequently washed and individually immersed in 2mL of 65% nitric acid solution for 24 hours. Dye uptake levels were measured by absorbance analysis in a spectrophotometer, and averages were compared by ANOVA and Tukey's test. Finishing Gloss and the nail varnish provided the best results. All cements tested must be protected during early setting periods.*

**Key-words**: glass ionomer cements, coating agents, dye absorbance, surface protection

## INTRODUCTION

Glass ionomer cements have good biocompatibility and release fluoride for a prolonged period of time. Nevertheless, these materials are susceptible to water absorption or dehydration during the setting reaction and after its completion.

In attempt to prevent such phenomenon, glass ionomer restorations are usually protected with a matrix and/or with coating materials such as cocoa butter, cavity varnish and petroleum jelly [11]. Some authors have stated that covering the restoration surface with a light-cured unfilled resin is the most effective method for reducing water sorption [2,4,12]. Nail varnish has also been cited in the literature as a surface protector for glass ionomers [3,9,11].

Although the consciousness in protecting glass ionomer cements, divergences exist in electing the best protector agent for each of the cements. Also, the necessity of a surface protection for light-cured glass ionomer cements

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is still questionable.

The purpose of this study was to evaluate the effectiveness of three protecting agents, two glaze-resins and one clear nail varnish, in reducing dye uptake of two conventional and one resin-modified glass ionomer cement.

## MATERIALS AND METHODS

The cements used in this study were two conventional glass ionomer cements, Vidrion R (VD, SSWhite, Brazil) and Chelon-Fil (CH, Espe, Germany), and one resin-modified Type II glass ionomer cement, Vitremer (VT, 3M, USA). The surface protectors tested were Fortify (FO, Bisco, USA), Finishing Gloss (FI, 3M, USA) and a clear nail varnish (CO, Colorama, Brazil).

Following the manufacturers' instructions, ten specimens were prepared for each group. The materials were injected into plastic rings (4.5 mm internal diameter and 2 mm deep) using a Centrix syringe. The conventional glass ionomer cements set in contact with polyester strips and between two glass plates under a 1000-g load. Vitremer specimens set also in contact with polyester strips and glass plates but without pressure. After a 20s light activation, the strips and glass plates were removed and an additional 40s light exposure was conducted.

Seven minutes after mixing, the hardened specimens were carefully removed from the molds and coated with the protective agents using a brush. For the light-cured resins, a 30-second light polymerization was carried out for each exposed surface. The nail varnish was allowed to dry for 5 minutes. Uncoated specimens were prepared as controls.

A method described by Serra et al 9 was used to quantify the effectiveness of the surface protection. Following the surface coating, each specimen was immersed separately into 3 ml of a 0.05% methylene blue solution at 37ºC. After 24 hours, the discs were removed, washed with 50ml of deionized water, and individually placed in 2mL of a 65% nitric acid solution for 24 hours. The solutions were then diluted in 2ml of deionized water, filtered and centrifuged. The absorbance of the supernatant was determined at 590 nm light wave-length using a spectrophotometer (Jenway 6300). The effectiveness of the surface treatments was determined by the optical density (OD) values. The lower the OD the better the protection.

## RESULTS

Statistical analysis of collected data consisted of a two-way analysis of variance and Tukey's test at a significance level of 5%.

Means and standard deviations for dye uptake analysis are presented in Table 1. All brands exhibited a similar behavior for dye infiltration, with the unprotected samples showing significant higher values.

Differences were detected among protective agents for CH and VT ($p<0.05$), while VD exhi-

**Table 1: Results for optical density (O.D.) analysis**

| Surface protector | Glass ionomers | | |
|---|---|---|---|
| | Vidrion | ChelonFil | Vitremer |
| **Nail varnish** | 0.375+0.078 A a | 0.208+0.076 A a | 0.357+0.126 AB a |
| **Fortify** | 0.426+0.132 A a | 0.406+0.153 B a | 0.480+0.135 B a |
| **Finishing gloss** | 0.266+0.052 A a | 0.212+0.081 A a | 0.257+0.042 A a |
| **Conyrol (no protector)** | 1.652+0.401 B a | 1.800+0.292 C a | 1.649+0.490 C a |

Means followed by the same letter are not different ($p>0.05$). Upper case letter for vertical comparisons and lower case ones for horizontal comparisons bited equal values of dye uptake for all protectors tested ($p>0.05$). FI and CO did not differ for CH and VT samples ($p>0.05$). FO was less effective than FI and CO in protecting CH, and differed only from FI gloss for VT samples ($p<0.05$).

## DISCUSSION

According to the literature [6,7,10], the higher resistance to water loss and uptake for light-cured ionomer cements is conferred by their polymeric phases, which protects the matrix and prevent lixiviation. However, some resin-modified glass ionomer cements have shown a continuation of the chemical setting reaction within a 24-hour period after mixing [1], which probably make them susceptible to water loss and uptake within this period of time. Um & Oilo [10] found a lower depth of dye penetration in light-activated ionomer samples than in chemically-activated ones. Contrarily, this study did not detected differences for dye penetration between the light- and chemical-activated ionomer cements, here useded.

Surface protection of glass ionomer materials can influence water uptake [5,8,10] and some mechanical properties [6] of glass ionomer materials. Similarly, this study detected a statistical significant difference for water uptake between protected and unprotected samples. Despite the effectiveness of surface protection, one should be aware that the surface coating will protect glass ionomer restorations against water intrusion from the surface that faces the oral cavity only, and not against water penetration from the dentine side [5].

No differences were detected among surface protectors for one of the two conventional glass ionomer cements tested. Also, when protecting CH and VT cements, the resin-based agent FO was less effective than FI in reducing water uptake, probably because FO is a surface protecting sealant mainly indicated for composite materials and not for glass ionomer cements. Earl et al. [2] detected differences in restriction of water movement in glass ionomer cements among light-activated bonding resins and suggested that there may be a physicochemical interaction occurring on the glass ionomer cement surface with some of the resins. FI is a BISGMA-based material, while FO is a urethane-based one. A chemical bond between the resin agents and the HEMA-based cement VT probably occurred in different extensions and influenced the protection against water uptake. Besides the physicochemical interactions between cement and protective agent, the surface energy and permeability of the protective agent, which will determine, respectively, the adsorption and consequent absorption of fluids towards the cement, may influence the effectiveness of the protection.

Nail varnishes have been shown to be an effective surface agent for glass ionomer cements [3,9,11]. According to Serra et al. [9], the hydrophobicity conferred by their nitrocellulose-based composition reduces the water absorption into the glass ionomer cement. Similarly, this study detected a considerable effectiveness of the nail varnish in preventing water uptake. However, since this material is obtained from formaldehyde and toluene sulfonamide, toxicological concerns should be raised when using it intra-orally.

## CONCLUSIONS

From the results obtained we can conclude that:

- The unprotected groups exhibited the highest values of dye uptake;
- The cements tested must receive surface protection during the first 24 hours;
- Finishing Gloss and Colorama nail varnish were the most effective protective agents;
- Fortify was the least effective protective agent.

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