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Original Article

Preheating impact on the colour change of pit-and-fissure sealants after immersion in staining beverages

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ABSTRACT

Background: The development of techniques improving the colour stability on restorative materials has become of great importance due to pigmentation as an important factor that induces colour changes. This study aimed to evaluate the influence of the preheating of resin-based pit-and-fissure sealants on colour stability when in contact with staining beverages.

Methods: The Fluroshield (Dentsply, USA) sealant was used in white and clear shades. One hundred and twenty specimens were light-cured at different temperatures (25 °C and 68 °C) and immersed in distilled water (37 °C) for 24 h (T0). Thereafter, the specimens were submerged in different solutions, such as cola soft drinks, distilled water or grape juice ($n = 10$), for 7 days (T1) (37 °C). The colour was measured by a digital spectrophotometer (Easy Shade, Vita Zahnfabrik) right after T0 and T1 following the CIE-L*a*b* parameter. Results were obtained after calculating the colour change after T1 (ΔE) and analysed through 3-way ANOVA test and Tukey post hoc test ($p < 0.05$).

Results: Preheating resulted in decreased colour change in both materials. The white Fluroshield sealant showed lower ΔE values and grape juice promoted the highest colour change.

Conclusion: The preheating was effective to improve colour stability of resin-based pit-and-fissure sealants when in contact with grape juice and cola drink.

1. Introduction

Pit-and-fissure sealants are utilised to cover teeth surfaces that are anatomically predisposed to food accumulation. These materials act building up a protective pellicle or a physical barrier between teeth surface and oral environment. Therefore, the accumulation of food debris is prevented, which facilitates cleaning and can consequently avoid carious process.[1] Beyond the preventive action, pit-and-fissure

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sealants also proved therapeutic function, arresting the progression of non-cavitated carious lesions, even those extending up to dentine.[2] In face of that, pit-and-fissure sealing is considered an important method to prevent the appearance and progression of carious lesions.[1] For that reason, the extensive use on paediatric dentistry can be justified.

The aesthetic aspect of pit-and-fissure sealants is also taken into consideration and expected in addition to preventive and therapeutic action, as these materials can be significantly compromised by discolouration. Resin-based pit-and-fissure sealants, as well as resin-based materials, are more likely to acquire several degrees of discolouration when subjected to intrinsic and extrinsic factors.[3,4] As an intrinsic factor, the composition of resin matrix and their respective chemical change can be mentioned. Aspects such as degree of conversion acquired by organic matrix of a composite are determinant factors for colour stability. The amount of converted monomers into polymers during polymerisation is directly proportional to staining resistance.[3] On the other hand, considering the material colour as an extrinsic factor, darker materials are less likely to absorb pigments and adsorb or absorb exogenous substances, for instance, from food.[4] Beverages such as grape juices and cola soft drinks are consumed by children and can cause distinct degrees of stains on these materials, ranging according to each composition.

The preheating of resin-based materials before contact with dental surface – and light-curing – is a technique that have been studied and developed to improve physical and mechanical properties of these materials. Heating induces the conversion of a greater amount of monomers into polymers, reducing the number of free monomers and perhaps avoiding negative consequences previously mentioned.[5] Despite some assumptions, there is a lack of studies proving the effectiveness of preheating resin-based pit-and-fissure sealants with different shades on the colour stability. As pigmentation is considered an important factor that justifies changes, sealant application will allow better mechanical and mainly aesthetic properties. Therefore, investigations that analyse the efficacy of the preheating of resin-based pit-and-fissure sealants are of great value for scientific and dental community.

The aim of the present study was to evaluate the influence of the preheating of resin-based pit-and-fissure sealants of different shades on colour stability when in contact with distilled water, grape juice and cola soft drinks. The null hypothesis tested was that the preheating had no influence on the material stainability, regardless of the type of beverage and material shade.

Table 1 – Commercial name, composition, lot number and manufacturer of materials used at the study.

Material	Composition	Lot	Manufacturer
Fluroshield	Urethane Bis-GMA; Dimethacrylate resins; Barium aluminoborosilicate glass; Sodium fluoride; Photoinitiator; Photoaccelerators; Silicon dioxide	917348F (White); 876466F (Clear)	Dentsply/Caulk, Milford, DE, USA

2. Materials and methods

2.1. Samples preparation

To perform this work, Fluroshield pit-and-fissures sealant (Dentsply, USA) was utilised in white and clear shades. Chemical composition, lot number and manufacturer of each material are shown in Table 1. As staining beverages, grape juice (Del Valle Mais, Coca-Cola, Brazil), cola soft drink (Coca-Cola, Brazil) and distilled water were used. The pH of solutions was verified using a pH meter (Bench top pH meter, model NT-PHM/NT-PHP, Nova Técnica, Piracicaba, Brazil) (Table 2).

One hundred and twenty specimens were prepared using a Teflon mould (5 mm diameter and 1 mm thickness). Specimens were divided into groups according to the used sealant (white or clear), the temperature (68 °C, preheated; and 25 °C, room temperature) and the type of staining solution in which they were stored (distilled water, grape juice and cola soft drink), totalling 12 groups ($n = 10$).

The Teflon mould was positioned on a glass plate. Pit-and-fissure sealants were introduced on the centre of the matrix. Using an infrared thermometer (model MS6530H, Commercial Electric, Atlanta, USA), final temperatures of the sealant were measured before light-curing. All specimens were light-cured for 20 s by a light-emitting diode (LED) device (Coltolux LED, Coltène, Switzerland). The distance between the light source and the sample was standardised in 1 mm using the glass plate on the Teflon mould, as the tip of the instrument was always in contact with the blade during the polymerisation process.

The heating process of the sealant was performed by storing the materials in an incubator (model 315 SE, FANEM, São Paulo, Brazil) at 68 °C for 2 h before using.[6,7] In the

Table 2 – Staining beverages used at the study.

Storage solution	Composition	pH	Lot	Manufacturer
Del Valle Mais grape juice	Water, concentrated grape juice, sugar, natural scent, citric acid and xanthan gum thickener	3.3	MM P190614	Coca-Cola®, Brazil
Cola soft drink	Aerated water, sugar, kola nut extract, caffeine, caramel IV pigment, INS 338 acidulant and natural scent	2.9	21621P020814	Coca-Cola®, Brazil
Distilled water	–	6.3	–	–