



UNIVERSIDADE FEDERAL DE UBERLÂNDIA
FACULDADE DE ODONTOLOGIA



FERNANDA TEODORO NEVES

**EFEITO IMEDIATO E TARDIO DA
INIBIÇÃO DE OXIGÊNIO E DO
ACABAMENTO E POLIMENTO NAS
PROPRIEDADES FÍSICO-QUÍMICAS DE
RESINAS COMPOSTAS
CONVENCIONAIS E BULK- FILL**

UBERLÂNDIA

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Trabalho de conclusão de curso
apresentado à Faculdade de Odontologia da
UFU, como requisito parcial para obtenção
do título de graduado em Odontologia.

Orientadora: Prof^a Dr. Gisele Rodrigues
Silva.

Coorientadora: Ms. Marcela Borges

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2017



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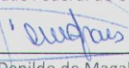
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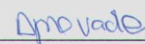
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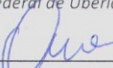
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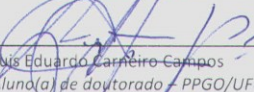

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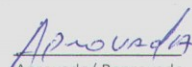

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AGRADECIMENTOS

Agradeço a Deus por ter me dado saúde e inteligência para superar todas as dificuldades e conseguir chegar onde hoje estou.

Aos meus pais, irmãos, meu noivo e a toda minha família que, com muito carinho e apoio, não mediram esforços para que eu chegasse até esta etapa da minha vida.

À Universidade Federal de Uberlândia pelo excelente ambiente oferecido aos seus alunos e aos profissionais qualificados que disponibilizam para nos ensinar.

À professora orientadora Gisele Rodrigues da Silva e a co-orientadora Marcela Borges por toda atenção, dedicação e esforço para que eu pudesse ter confiança e segurança na realização deste trabalho.

SUMÁRIO

- 1) Resumo, Relevância clínica, Introdução, Material e Métodos, Resultados e Discussão, Agradecimentos, Conclusão, Referências

Immediate and delayed effect of oxygen inhibition, finishing and polishing surface procedures on the physico-chemical properties of conventional and bulk-fill composite resins

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Running title: Effect of the oxygen inhibition, finishing and polishing on the physico-chemical properties of composite resins

Keywords: dental materials; composite resins; color changes, conversion degree.

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Immediate and delayed effect of oxygen inhibition, finishing and polishing surface procedures on the physico-chemical properties of conventional and bulk-fill composite resins

Abstract

Objectives: The aim of this *in vitro* study was to investigate immediate and delayed effect of oxygen inhibition, finishing and polishing surface procedures on the degree of conversion and shade matching of conventional and bulk-fill composite resins.

Materials and methods: Two conventional composite resins, Z350 nanoparticle (Filtek Z350 XT, 3M ESPE) and Z250 microhybrid (Filtek Z250, 3M ESPE), and one bulk-fill composite resin, FP (Filtek Posterior Bulk-Fill, 3M ESPE) were tested in this study. The degree of conversion (DC) of composite resins was monitored using Spectroscopy (FTIR) immediately and then again after 15 days. Shade matching was evaluated using the Spectrophotometer after 24 hours and then again after 15 days of challenge with immersion of coffee. The specimens were divided into 12 groups, according the type of composite resin, finishing and polishing surface procedures and moment of analysis (n=5). The data were statistically analyzed using two-way ANOVA, Tukey's and Dunnet tests ($\alpha = 0.05$). DC data passed by Shapiro-Wilk normality test and by equality of variance. Two-way repeated measures ANOVA and Tukey's test ($p < 0.05$) were then applied. Opacity data were tested on the Shapiro-Wilk normality test and equality of variance. Then, Two-way repeated measures ANOVA and Tukey's test ($p < 0.05$) were applied.

Results: Surface treatment had an influence on conversion composite degree for all composites analyzed. Bulk-fill show higher Δa than others composites and finishing and polishing can reduce this parameter. Finishing and polishing procedures can reduce Δb especially on bulk fill and nanoparticles resins. There was a difference in the opacity of the composite resins, regardless surface treatment. Microhybrid composite showed higher opacity, followed by nanoparticle and bulk-fill and ΔL variation was higher to nanoparticle followed by bulk-fill and microhybrid resin and finishing and polishing resulted on the least ΔL .

Conclusion: The oxygen inhibition can increases the conversion degree of composites resins tested and immediately finishing and polishing procedures associating with

previous oxygen inhibition can reduce the color variation (ΔE) after immersion of coffee.

Clinical Relevance

Composite resins demonstrate increased degree of conversion when surface received oxygen inhibition, moreover, immediately finishing and polishing surface procedures associating with previous oxygen inhibition can reduce the color variation (ΔE) after immersion of coffee.

1. Introduction

The composite resins are materials widely used in daily practice and adequate polymerization is fundamental to good clinical performance.⁽¹⁻³⁾ These materials are in a constant process of chemical degradation in the oral cavity due to diets that contain a variety of colored and acidic foods and drinks.^(4,5) This impact may lead to an additional expense for early replacement of restorations and can hamper the clinical performance of composite resins.⁽⁶⁾

The degree of conversion of monomers is determined by the percentage of double bonds of carbon that were transformed into simple links after activation and subsequent chemical process.⁽⁷⁾

Based on our knowledge, no study has tested the physical and chemical properties of different types of composite resin with oxygen inhibition layer, finishing and polishing surface procedures and cumulative deleterious effects with immersion of coffee. Therefore, the null hypothesis was that the degree of conversion and shade matching cannot be influenced by the composite resins tested, oxygen inhibition and finishing and polishing procedures.

2. Materials and Methods

2.1 Specimen preparation

Two conventional composite resins, Z350 nanoparticle (Filtek Z350 XT, 3M ESPE, Maplewood, Minnesota, USA) and Z250 microhybrid (Filtek Z250, 3M ESPE), and one bulk-fill composite resin, FP (Filtek Posterior Bulk-Fill, 3M ESPE) were tested in this study. The materials used are listed in Table 1. The composite resin was inserted into a silicone mold (HydroXtreme, Vigodent S/A Indústria e Comércio, Rio de Janeiro, Rio de Janeiro, Brazil) with internal dimensions of 4 mm x 2 mm (ISO 4049) to the

degree of conversion. To the shade matching, the composite resin was inserted into a teflon mold with dimensions of 8 mm x 2 mm. The surface of each disc-shaped specimen was covered by a polyester strip and pressed flat by a glass slab. The strip was removed and specimens were light activated for 20s. With halogen light curing unit (OptiLux 501, Demetron, 3m, Danbury, CT, USA) with 600 mW/cm². After, specimens were prepared according different surface treatments: *Control group*: the specimens were additionally photocuring for 20s. *Glycerin surface treatment*: glycerin (Biopharma - Compounding pharmacy, Uberlândia, MG, Brazil) was applied on surface of specimens and after additionally light activation to oxygen inhibition for 20s was performed. *Finishing and polishing procedure*: the specimens were additionally photocuring for 20s and after, with abrasive disc Sof-lex (3M/ESPE), light blue in color, is ten moves, cleaned with distilled water and gauze, then ten more movement with abrasive disc Sof-lex Pop-on 4931sf 1/2 extra-fine yellow, clean the sample with distilled water; for polishing is performed ten movements with polishing compound Fotoacrill (Dhpro, Paranagua, Paraná, Brazil) and felt disk Diamond FGM (Joinville, Santa Catarina, Brazil), in this last step wiped if the surface of the sample with alcohol 70% (Itajá, Goianésia, Goiás, Brazil) with friction and drying with air syringe, both for 10 seconds.

Glycerin + finishing + polishing procedure: after glycerin surface application and light activation for 20s, the finishing and polishing procedure were performed according above mentioned.

2.2 Degree of conversion (n=5)

The degree of conversion (DC) was monitored immediately and then again after 15 days using Fourier Transformed Infrared Spectroscopy (FTIR- Vertex 70, Bruker Optik GmbH, Ettlingen, Germany). For the evaluation after 15 days, specimens were stored in a dry and in a dark at 37°C. The DC was assessed using FTIR with attenuated total reflectance (ATR crystal) sampling, mid-infrared (MIR) and deuterated triglycine sulfate (DTGS) detector elements (Bruker Optik), with a 4 cm⁻¹ resolution and co-addition of 32 scans. All analyses were performed under temperature (25±1°C) and humidity (60±5%) conditions controlled. The DC was calculated from the equivalent

aliphatic (1640 cm^{-1}) and aromatic (1610 cm^{-1}) molar ratios of cured (C) and uncured (U) composite resin specimens according to the following equation: $DC = (1 - C/U) \times 100$.⁽²³⁾

2.3 Immersion of coffee and Shade matching (n=5)

The color analysis was first carried out immediately after specimen preparation. Then, after 24h stored in a dry and in a dark at 37°C , which specimen was individually in 1 mL of challenge with solution of coffee (Nestlé Brasil LTDA, São Paulo, São Paulo, Brazil) for 15 days⁽²⁴⁾. The solution was exchanged daily. The specimens were kept at 37°C . After storing, the excess was removed, and after 15 days, the specimens were ultrasonically (Ultrasonic Cleaner, Thornton – INPEC, Vinhedo, São Paulo, Brazil) washed in distilled water for 10 minutes and dried.

The readings assessed at immediately were used as baseline for the analysis of color variation. The baseline color coordinates were assessed in standard conditions by means of a reflectance spectrophotometer (Ci64UV, Xrite, Chandler, Arizona, USA). The device was adjusted for the D65 light source, with 100% ultraviolet and specular reflection included. The observer angle was set at 2 degrees, and the device was adjusted to a small reading area (SAV), with a total area of 4 mm^2 . The spectrophotometer was adjusted for three consecutive readings, which were later averaged. The results of the color readings were quantified in terms of the L^* , a^* , b^* coordinate values established by the Commission Internationale de l'Eclairage (CIELAB system), in which the L^* axis represents the degree of lightness within a sample and ranges from 0 (black) to 100 (white). The a^* plane represents the degree of green/red, and the b^* plane represents the degree of blue/yellow. The measurement of color change after aging process was made calculating the variation (delta - Δ) of L^* (ΔL), a^* (Δa), and b^* (Δb). The total color change (ΔE) was calculated according to the following formula: $\Delta E = (\Delta L^2 + \Delta a^2 + \Delta b^2)^{1/2}$.

3. Results

DC data passed by Shapiro-Wilk normality test and by equality of variance. Two-way repeated measures ANOVA and Tukey's test ($p < 0.05$) were then applied.

Surface treatment had an influence on conversion composite degree ($p < 0.001$) for all composites analyzed.

4. Discussion

In the present study, the physical and chemical performances of conventional and bulk-fill composite resins, as expressed by the degree of conversion and shade matching were affected by the surface treatment and moment of analysis. Therefore, the null hypothesis of this study was rejected.

DC which is the proportion of single carbon-carbon bonds in a polymer matrix to double carbon bonds between monomers,⁽²⁵⁾ implies the conversion of monomers to polymers and is an index for the extent of polymerization. It has been shown that the clinical performance of dental composites can be affected by the DC.⁽²⁵⁾ An inadequate degree of conversion (e.g. low DC) might weaken bonding strengths, lower physicommechanical properties, release toxic materials such as monomers and initiators,⁽²⁶⁾ and cause permeability of bonded interfaces for resin based materials. Suboptimal polymerization might lead to unfavorable changes, causing restoration detachment, caries formation, or discoloration around the adhesive, all of which are of clinical concern.⁽²⁷⁾

2.6 Conclusion

Within the limits imposed in the experimental design:

- The oxygen inhibition with glycerin can increase the conversion degree of composites resins.
- Immediately finishing and polishing procedures associating with previous oxygen inhibition can reduce the color variation (ΔE) after immersion of coffee.

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Anexos:

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- Journal article: two authors
Evans DB & Neme AM (1999) Shear bond strength of composite resin and amalgam adhesive systems to dentin *American Journal of Dentistry* 12(1) 19-25.
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