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INFLUÊNCIA DO SISTEMA ADESIVO NA COR DE RESINAS COMPOSTAS

DISSERTAÇÃO DE MESTRADO

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Santa Maria, RS, Brasil

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INFLUÊNCIA DO SISTEMA ADESIVO NA COR DE RESINAS COMPOSTAS

Débora Diniz Ritter

Dissertação apresentada ao Curso de Mestrado do
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A Comissão Examinadora, abaixo assinada,
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INFLUÊNCIA DO SISTEMA ADESIVO
NA COR DE RESINAS COMPOSTAS

elaborada por

Débora Diniz Ritter

como requisito parcial para obtenção do grau de
Mestre em Ciências Odontológicas

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Santa Maria, 02 de julho de 2015.

DEDICATÓRIA

Dedico este trabalho primeiramente a Deus, que me deu a vida e também uma segunda oportunidade para que eu continuasse a trilhá-la.

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"A gratidão é a memória do coração."

Antístenes (440 - 365 a.C.)

RESUMO

Dissertação de Mestrado
Programa de Pós-Graduação em Ciências Odontológicas
Universidade Federal de Santa Maria

INFLUÊNCIA DO SISTEMA ADESIVO NA COR DE RESINAS COMPOSTAS

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Data e local da Defesa: Santa Maria, 02 de julho de 2015.

O objetivo deste estudo foi avaliar a influência de diferentes sistemas adesivos na cor de resinas compostas com diferentes translucidez. Sessenta corpos de prova de resina composta Z250 XT (3M ESPE), nas cores A2 (n=30) e OA2 (n=30) foram confeccionados com auxílio de uma matriz metálica com 8 mm de diâmetro interno e 1,25 mm de espessura e divididos aleatoriamente de acordo com o sistema adesivo: convencional de dois passos (Adper Single Bond 2; 3M ESPE), autocondicionante de dois passos (Clearfil SE Bond; KURARAY) e universal (Single Bond Universal; 3M ESPE). Os materiais foram aplicados sobre a superfície dos corpos de prova, simulando restaurações diretas. As avaliações de cor foram mensuradas com espectrofotômetro imediatamente após o polimento dos corpos de prova e posteriormente à aplicação dos sistemas adesivos. Os dados do sistema CIE L*a*b* foram utilizados para o cálculo do ΔE, ΔL, Δa e Δb. Adicionalmente, 5 corpos de prova de cada sistema adesivo foram confeccionados com as mesmas dimensões dos corpos de prova de resina composta para mensuração dos parâmetros L*, a* e b*. Os dados obtidos foram submetidos à Análise de Variância e Teste de Tukey (5%). A aplicação do sistema adesivo Single Bond Universal sobre a resina composta A2 resultou em maior alteração de cor ($p = 0,000$; $\Delta E = 3,1 \pm 0,7$). Nenhuma diferença estatisticamente significante foi observada entre os sistemas adesivos quando aplicados sobre a resina composta cor OA2 ($p>0,05$). O adesivo universal apresentou maior tendência para o verde e para o amarelo. Em conclusão, o efeito do sistema adesivo na cor das resinas compostas é material dependente. O adesivo Single Bond Universal resulta em maior alteração de cor quando uma resina com maior translucidez é utilizada.

Palavras-chave: Cor. Estética Dentária. Resinas Compostas. Sistema adesivo.

ABSTRACT

Master's Degree Dissertation
Post Graduate Program in Dental Science
Federal University of Santa Maria

INFLUENCE OF THE ADHESIVE SYSTEM IN THE COLOR OF RESIN COMPOSITES

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Date and local of defense: Santa Maria, July 02, 2015.

The aim of this study was to evaluate the influence of different adhesive systems in the color of resin composites with different translucency. Sixty specimens of resin composite, in the shades A2 (n=30) e OA2 (n=30) were made with aid of a metallic mould with 8 mm of intern diameter and 1.25 mm of thickness, and randomly divided according to the adhesive system: two-step etch-and-rinse (Adper Single Bond 2; 3M ESPE), two-step self-etch (Clearfil SE Bond; KURARAY) and universal (Single Bond Universal; 3M ESPE). The materials were applied on the surface of the disk-shaped specimens, simulating direct restorations. The color evaluations were measured with spectrophotometer immediately after the polishing the specimens and after the application of the adhesive systems. The data of CIE L*a*b* system were used for the calculus of ΔE, ΔL, Δa e Δb. Additionally, 5 specimens of each adhesive system were made with the same dimensions of the disks of resin composite for measurement of the L*, a* e b* parameters. The data obtained were subjected to Analysis of Variance and Tukey test (5%). The application of the adhesive system Single Bond Universal on resin composite A2 resulted in highest color change p= 0.000; $\Delta E = 3.1 \pm 0.7$). No statistical significant difference was observed among adhesive systems when applied on resin composite shade OA2 ($p>0.05$). The universal adhesive showed higher trend to green and yellow. In conclusion, the effect of the adhesive system is material-dependent. The adhesive Single Bond Universal results in higher color change when a resin composite with higher translucency is used.

Key words: Color. Esthetics, Dental. Composite Resins. Adhesive System.

LISTA DE TABELAS

LISTA DE REDUÇÕES

ANOVA	Análise de variância
Bis-GMA	Bisfenol A glicidil metacrilato
Bis-EMA	Bisnenol A metacrilato etoxilado
ºC	Graus Celsius
ΔE	Delta E
ΔL	Delta L
Δb	Delta b
Δa	Delta a
h	Horas
HEMA	2-hidroxietil metacrilato
MDP	10-metacriloiloxidecil dihidrogênio fosfato
mm	Milímetros
mW/cm^2	MiliWatts por centímetro quadrado
n	Número de corpos de prova por grupo
%	Por cento
s	Segundos
TEGDMA	Trietilenoglicol dimetacrilato
UDMA	Uretano dimetacrilato

SUMÁRIO

INTRODUÇÃO

A admiração pelo belo faz com que a estética seja uma aspiração da sociedade moderna. Isto tem reflexos diretos na prática odontológica, com o anseio por um sorriso perfeito, dentes alinhados e cada vez mais brancos. O desejo por restaurações imperceptíveis, viabilizadas desde a proposta do condicionamento ácido do esmalte (BUONOCORE, 1955), impulsionaram o desenvolvimento de resinas compostas e sistemas adesivos.

Restaurações estéticas diretas representam uma alternativa conservadora para dentes anteriores com alteração de cor ou da forma anatômica e têm sido amplamente utilizadas para a correção do sorriso, uma vez que envolvem menor custo e tempo clínico em relação às facetas laminadas de porcelana. No entanto, apesar da evolução de suas propriedades mecânicas, a estabilidade da cor das resinas compostas continua sendo um grande desafio, sendo um dos principais motivos para a substituição destas restaurações (MUNDIM et al., 2010; BALDISSERA et al., 2013).

A estabilidade de cor pode ser afetada pela degradação da superfície da restauração que implica em alteração do índice de refração do material (FERRACANE et al., 2006; HADIS et al., 2010; CATELAN et al., 2011) e/ou pela degradação da interface adesiva (FERRACANE, 2008). Todavia, a aparência estética inicial de qualquer restauração é influenciada pela cor e espessura do material restaurador, bem como, pelo substrato dental remanescente (POWERS et al., 1978; YOUNG-KEN & POWERS, 2007).

Em Odontologia, a avaliação de cor pode ser realizada através de métodos visuais ou instrumentais (POWERS & SAKAGUSHI, 2006). O método visual mede a cor por meio de comparações subjetivas usando diferentes escalas colorimétricas. Por outro lado, as técnicas instrumentais são medidas objetivas, rápidas e confiáveis obtidas por aparelhos, como os espectrofotômetros, sendo preferíveis em relação às avaliações visuais (MEIRELES et al., 2008). O espectrofotômetro mede os comprimentos de onda da reflectância ou transmitância de um objeto, podendo ser utilizado para mensurar o espectro de luz de dentes e materiais restauradores (JOINER, 2004).

A determinação instrumental da cor pode ser expressa pelo sistema CIE L*a*b* (Comission International l`Eclairane) onde o parâmetro L* refere-se à coordenada luminosidade e seus valores variam de 0 (preto) a 100 (branco). As variáveis a* e b* são coordenadas relativas à cor nas axiais vermelho-verde e amarelo-azul, respectivamente. Valores positivos de a* indicam tendência para o vermelho, e os negativos para o verde. Similarmente, os valores positivos de b* indicam uma tendência para o amarelo e os negativos, para o azul. Dessa forma, é possível realizar comparações entre diferentes mensurações utilizando as leituras de L*a*b* de cada medida e através de fórmulas pré-definidas que representam a variação de cor (ΔE). A vantagem deste sistema é que a diferença de cor obtida é expressa numericamente, podendo ser relacionada à percepção visual e significância clínica (O`BRIEN et al., 1997).

As evidências científicas atuais têm demonstrado que a cor do sistema de cimentação e do substrato subjacente afeta o aspecto final das restaurações indiretas em cerâmica (HEYDECKE et al., 2001; DOZIC et al., 2010; MAGALHÃES et al., 2014). Todavia, o mesmo ainda não está bem definido para as resinas compostas.

Enquanto alguns estudos demonstraram que os sistemas adesivos são capazes de influenciar na cor de restaurações estéticas diretas (GAINTANTZOPOULOU et al., 2009; ALABDULWAHHAB et al., 2014), os resultados de uma recente pesquisa sugerem o oposto (OLIVEIRA et al., 2014). Considerando a dinâmica evolução dos sistemas adesivos, bem como as diferenças em termos de composição, a investigação do efeito de diferentes sistemas adesivos na cor de resinas compostas é extremamente relevante.

Ademais, translucidez e opacidade são consideradas propriedades vitais para as resinas compostas, uma vez que são indicativos de qualidade e quantidade de reflexão de luz (WINTER, 1993). A translucidez das resinas depende da espessura do material, coeficiente de absorção e espalhamento, partículas de carga, pigmentos e opacificadores (LEE, 2008; YU & LEE, 2008). Assim, o impacto do sistema adesivo na cor das resinas compostas pode ser dependente também do grau de translucidez destes materiais.

Conforme supracitado previamente, a estabilidade de cor de resinas compostas é de grande relevância clínica, e os fatores que podem interferir até mesmo na alteração de cor imediata dos diferentes tipos e composições de resina composta ainda não estão sedimentados na literatura e são necessárias mais evidências científicas. Assim, parece relevante a realização de estudo que avalie a influência de diferentes sistemas adesivos na cor de restaurações diretas de resina composta com diferentes translucidez.

PROPOSIÇÃO

O objetivo desta dissertação é apresentar um artigo que aborda a investigação do efeito de diferentes sistemas adesivos na cor de resinas compostas.

ARTIGO

Esta dissertação está baseada nas normativas da Universidade Federal da Santa Maria. Sendo assim, é composta de um artigo que será enviado para publicação no periódico "*The Journal of Adhesive Dentistry*". As normas para publicação estão descritas no Anexo.

"Influence of adhesive systems on the color match of resin composites"

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Title page

Influence of adhesive systems on the color match of resin composites

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Abstract

Purpose: To evaluate the influence of adhesive systems on the color match of a resin composite with different translucency. *Methods*: Sixty disk-shaped specimens (8 mm in diameter and 1.25 mm in thickness) were made with A2 and opaque A2 (OA2) shades of nanohybrid resin composite Z250 XT (3M ESPE). Specimens of each shade (n = 30) were randomly reassigned to three subgroups according to the adhesive system: a two-step etch-and-rinse adhesive (Adper Single Bond 2; 3M ESPE), a two-step self-etch system (Clearfil SE Bond; Kuraray), and a universal adhesive (Scotchbond Universal Adhesive; 3M ESPE). The bonding agents were applied to resin composite specimens following the manufacturers' recommendations. Additionally, 5 disk samples of each adhesive system (n=15) were prepared. The colorimetric evaluation (CIE L*a*b* system) was performed immediately after polishing the sample and application of the adhesive systems. Color changes (ΔE) were calculated between two measurements. Color coordinates L* a*, and b* of the adhesive disks also were assessed. The data obtained were analyzed using ANOVA and Tukey's post hoc tests ($\alpha = 0.05$). The application of Scotchbond Universal Adhesive to the resin composite A2 shade resulted in the highest color change ($p = 0.000$; $\Delta E = 3.1 \pm 0.7$). However, no significant difference was observed among adhesive systems when applied to the resin composite OA2 shade ($p>0.05$). Scotchbond Universal Adhesive revealed augmented yellowing and greening in comparison with other experimental groups. In conclusion, the effect of adhesive systems on the immediate color of resin composites is material-dependent. The tested universal adhesive results in more color changes when a higher translucency resin composite is used.

Keywords: adhesives; resin composite; color; direct esthetic restorations

Introduction

Resin composites have been widely used in direct esthetic restorative procedures. The clinical challenges of direct resin restorative approaches involve the fulfillment and maintenance of color match with tooth structure.[14] The esthetic appearance of any restoration is influenced by the optical properties, such as color and translucency, and the thickness of the restorative material, as well as the underlying dental substrate.[4,16]

Although there is evidence to suggest that shade options of resin cements may affect the final appearance of the ceramic indirect restorations,[2,6,19] it is not well established in scientific literature if the adhesive systems could have a similar effect on resin composite restorations.

While some studies have shown that the adhesive system plays an important role in changing the color of direct composite restorations,[1,5] the results of a recent investigation suggest the opposite.[14] Furthermore, considering the wide variation in color and composition of the commercially available adhesives, studies evaluating different adhesive systems are necessary. To the best of our knowledge, this is a pioneering investigation that assessed if a new generation of adhesive systems, referred to as universal adhesives, can influence the color of esthetic restorations.

Likewise, the effect of the adhesive system could be dependent on the opacity of the restorative material. Therefore, this *in vitro* study aimed to investigate the influence of adhesive systems on the color match of a resin composite available in two shades with different translucency.

Material and Methods

For this study, three adhesive systems were used: a two etch-and-rinse adhesive (Adper Single Bond 2, 3M ESPE, St. Paul, MN, USA), a two self-etch system (Clearfil SE Bond, Kuraray, Noritake, Japan), and a universal adhesive system (Scotchbond Universal Adhesive, 3M ESPE, St. Paul, MN, USA). The nanohybrid resin composite (Filtek Z250 XT, 3M ESPE, St. Paul, MN, USA) was tested in the A2 and opaque A2 (OA2) shades. A detailed description of the materials is presented in Table 1.

Specimen's preparation

Sixty disk-shaped samples (8 mm in diameter and 1.25 mm in thickness) were made from the two shades of resin composite (A2 and OA2) with the aim of simulating direct laminate veneers.

A single increment of resin composite was placed in a metallic mould, pressed between two glass plates and light cured for 20 s from the upper and the bottom surface, with a light emitting diode curing unit (Emitter B, Schuster, Santa Maria, RS, Brazil) with a light output of at least 1250 mW/cm^2. Light intensity output was monitored with a Demetron Curing Radiometer (Kerr, Orange, CA, USA). The specimens were stored in distilled water at 37°C for 24 h to ensure stabilization of the polymer network. After storage, specimens were polished using fine and extra-fine abrasive discs (SofLex Pop On, 3M ESPE, St. Paul, MN, USA) for 20 s each. The thickness of each specimen was confirmed with a digital caliper (Absolute Digimatic, Mitutoyo, Tokyo, Japan).

Composite disks of each shade (A2 and OA2) were randomly reassigned to three subgroups according to the adhesive system. This resulted in a 2 × 3 factorial experimental design, with ten specimens for each of the six subgroups formed from the crossing of two factors.

After polishing, the bonding agents of the different adhesive systems were applied to resin composite disks according to manufacturers' instructions (Table 1). A single trained operator performed all procedures.

Additionally, 15 disk-shaped samples (8 mm in diameter and 1.25 mm in thickness) were made solely from the three adhesive agents tested (n = 5). Each material was dispensed in a silicone mould and light cured for 20 s on each side of the disk. The thickness of each specimen was also measured with a digital caliper.

Color Analysis

The color was measured according to the CIE L*a*b* color scale relative to the standard illuminant D65 over a white background using a spectrophotometer (SP60 X-Rite, Grand Rapid, Michigan, USA). The color measurements were made immediately after polishing and after the application of the adhesive systems. The surface of the specimens with adhesive was turned down in the opposite side to the aperture of the spectrophotometer reader.

Three color readings were performed in each assessment with the spectrophotometer to establish the mean values. Color changes were calculated using the following formula: $\Delta E = (\Delta L^2 + \Delta a^2 + \Delta b^2)^{1/2}$.

The isolated coordinates were also separately analyzed to compare the variation of the color axes following the formulae: $\Delta L = L^*f - L^*i$; $\Delta a = a^*f - a^*I$; and $\Delta b = b^*f - b^*i$, in which "i" represents the initial analysis (after polishing) and "f" the final analysis (after adhesive application) of each specimen.

Color coordinates L* a*, and b* of the adhesive disks were also calculated considering an average value of three measurements.

Statistical analysis

The normal distribution of the data was confirmed using the Kolmogorov – Smirnov test. The ΔE, ΔL*, Δa*, and Δb* values were subjected to 2-way analysis of variance (ANOVA), using “adhesive system” and “resin composite” as variables. Color coordinates L* a*, and b* of the adhesive agents disks were analyzed by one-way ANOVA. Tukey’s HSD multiple comparisons statistical test at a 0.05 significance level was used. Statistical analyses were performed using the Minitab software (Minitab Inc., State College, PA, USA).

Results

Mean and standard deviation of ΔE, ΔL*, Δa*, and Δb* values considering the variables “adhesive system” and “resin composite” are presented in Table 2. The color change (ΔE) was influenced by the factors “adhesive system” ($F = 22.17$; $p = 0.000$) and “resin composite” ($F = 39.51$; $p = 0.000$), as well as, the cross-product interaction “adhesive system *vs.* resin composite” ($F = 17.02$; $p = 0.000$).

The application of Scotchbond Universal Adhesive to the resin composite A2 shade resulted in the highest color change. The Δa* and Δb* mean values revealed a greater variation in green-red and blue-yellow coordinates, indicating increased greening and yellowing in comparison with other experimental groups. However, no significant difference was observed among adhesive systems when applied to the resin composite OA2 shade.

Mean and standard deviation of L*, a*, and b* values of the adhesive systems are summarized in Table 3. The color of adhesives was only influenced by a* ($F = 64.65$; $p = 0.000$) and b* ($F = 109.28$; $p = 0.000$) parameters. Scotchbond Universal Adhesive showed a higher trend to green and yellow.

Discussion

The color of direct esthetic restorations is affected by the optical properties and thickness of the material selected and the background color. Clinically, the background of the resin composite restorations is usually composed of a hybrid layer of demineralized collagen and the light-cured resin monomers induced by the adhesive agents' application. Therefore, the adhesive systems could interfere with the final color of these restorations. To eliminate the interference of other factors on color data, such as subjacent substrate,[11,15] resin composite disks were not bonded to tooth structure, i.e., the bonding agents were only applied under restorative material.

In our study, the effect of the adhesive systems in the color of the nanohybrid resin composite was dependent on tested materials. Scotchbond Universal Adhesive showed the highest color change along the a* and b* coordinates, i.e., it induced color alteration towards green and yellow when applied to “resin composite A2 shade. A previous study[1] also reported that an adhesive can jeopardize the color of direct composite restoration, showing changes detected on the a* and b* values.

Conversely, it was also found that the adhesive systems had no influence on the color stability (ΔE) of either the restoration surface or the bonded interface.[14] Methodological differences relating to variations in sample thickness (range of 0.7–1.0 mm) may explain the controversial findings. However, the thickness value used in this study (1.25 mm) had a significant effect on the color changes. Thus, it was expected that the color changes in the resin composite are mainly related to the differences in the composition of the adhesive systems.

A greater yellowing effect is probably related to higher camphoroquinone and amine content because the excess of these components has a greater potential for darkness due to oxidative reactions.[18] It was estimated that the increased yellowing with universal adhesive occurred because of the lower conversion degree.[13]

Considering the association between color change and clinical significance, there is no consensus in scientific literature regarding the magnitude of the color difference that must be regarded as visually detectable or visually unacceptable.[7-9] Some authors have demonstrated that a ΔE value lower than 1.5 can be detected by a spectrophotometer, but cannot be detected by the human eye.[20] Nevertheless, ΔE > 2–3 is considered clinically perceptible, but with a slightly noticeable change, and ΔE > 3–8 represents moderate noticeable change, with clinical relevance.[7,17] Considering that 3.1 ΔE unit was found when using universal adhesive associated with resin composite A2, this material can impact the acceptability or perceivability of the initial color of esthetic restorations. Thus, although of "universal application" idea behind these new all-in-one adhesives, as Scotchbond Universal Adhesive, we could speculated that it is preferable to use the etch-and-rinse or self-etch adhesive systems tested for direct laminate veneers. Further studies are necessary to confirm this hypothesis.

Conversely, no significant color changes were observed for all the adhesives tested when applied to the resin composite OA2. The translucency of the resins depends on the material thickness, absorption coefficient, and scattering filler particles, pigments, and opacifiers.[10,21] In the current study, a single resin composite varying the opacity was used. The resin composite OA2 (opaque resin) presents higher opacity compared with A2 shade. In this sense, universal adhesive may compromise only the initial color performance of esthetic restorations restricted to dental enamel.

The color stability of direct restorations can be decreased by the surface degradation of the resin material or the bond interface[3,11] causing color change as clinically observed in esthetic restorations.[4] This effect seems to be proportional to the concentrations of hydrophilic monomers on the adhesive system because the hydrophilicity is increased, and a considerably higher amount of water is expected to be absorbed.[12] Therefore, further studies evaluating the influence of adhesive systems tested on color stability of resin composites are required.

In conclusion, the effect of adhesive systems on the immediate color of resin composites is material-dependent. The tested universal adhesive results in higher color changes when a more translucent resin composite is used.

Clinical relevance

Scotchbond Universal Adhesive may adversely affect the color of esthetics restorations when using a more translucent resin composites shades.

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Table 1 - Detailed description of the materials tested

Materials, Manufacturers and batch numbers	Main components	Application mode of bonding agent
Scotchbond Universal Adhesive (3M ESPE, St. Paul, MN, USA) #526247	Etchant: 34% phosphoric acid, water, synthetic amorphous silica, polyethylene glycol, aluminium oxide. *Bonding:* MDP phosphate monomer, dimethacrylate resins, HEMA, methacrylate-modified polyalkenoic acid copolymer, filler, ethanol, water, initiators, silane	Apply the adhesive for 20 s with vigorous agitation Gentle air thin for 5 s Light-cure for 10 s
Adper Single Bond 2 (3M ESPE, St. Paul, MN, USA) # N576767	Etchant: 35% phosphoric acid *Bonding:* HEMA, water, ethanol, Bis-GMA, dimethacrylates, amines, metacrylate-functional copolymer of polyacrylic and polyitaconic acids, 10% by weight of 5 nanometer-diameter spherical silica particles	Apply 2 consecutive coats of adhesive for 15 s with gentle agitation Gently air dry for 5 s Light-cure for 10 s
Clearfil SE Bond (Kuraray Noritake Dental Inc., Tokyo, Japan) #01882A	*Primer:* MDP, HEMA, hydrophilic dimethacrylate, dl-campherquinone,N,N-diethanol-*p*-toluidine, water *Bonding:* MDP, Bis-GMA, HEMA, hydrophobic dimethacrylate, dl-campherquinone, N,N-diethanol-*p*-toluidine, silanated colloidal silica	Apply bond for 20 s and gently air dry Light-cure for 10 s
Resin composite Z 250 XT A2 and OA2 shades (3M ESPE, St. Paul, MN, USA) #169373 #N377930BR	Bis-GMA, UDMA, Bis-EMA, TEGDMA, zirconia, sílica	

Abbreviations: MDP, 10-methacryloyloxydecyl-dihydrogen-phosphate; Bis-GMA, bisphenyl-glycidyl methacrylate; Bis-EMA, ethoxylated bis-phenol A methacrylat; HEMA, 2-hydroxyethyl methacrylate; TEGDMA, triethylene-glycol di-methacrylate; UDMA, urethane dimethacrylate

Table 2 - Mean and standard deviation of ΔE, ΔL*, Δa*, and Δb* values for all experimental groups

Resin composite	**A2**			**OA2**		
Adhesive system	**SB**	**SE**	**SBU**	**SB**	**SE**	**SBU**
ΔE	1.5 ± 0.5 ^{b}	0.9 ± 0.4 ^{b}	3.1 ± 0.7 ^{a}	0.8 ± 0.5 ^{b}	0.9 ± 0.6 ^{b}	1.0 ± 0.3 ^{b}
ΔL*	−0.3 ± 0.4 ^{a}	0.0 ± 0.4 ^{a}	−0.1 ± 0.3 ^{a}	−0.1 ± 0.4 ^{a}	−0.2 ± 0.5 ^{a}	−0.2 ± 0.4 ^{a}
Δa*	−0.2 ± 0.1^{a,b}	−0.2 ± 0.1^{a,b}	−0.3 ± 0.2^{a}	−0.1 ± 0.1^{b}	−0.2 ± 0.1^{b}	−0.1 ± 0.1^{b}
Δb*	1.3 ± 0.5^{b}	0.7 ± 0.4^{b}	2.9 ± 0.7^{a}	0.7 ± 0.5^{b,c}	0.5 ± 0.6^{c}	0.6 ± 0.6^{c}

Abbreviations: SB, Adper Single Bond 2; SE, Clearfil SE Bond; SBU, Scotchbond Universal Adhesive. Different superscript lower case letters indicate significant differences between rows, considering each Δ separately (n = 10; $p < 0.05$).

Table 3 - Mean and standard deviation of L*, a*, and b* values for each adhesive system

Coordinate	L*	a*	b*
Adper Single Bond 2	88.6 ± 0.3^{a}	−3.5 ± 0.1^{b}	23.3 ± 1.0^{b}
Clearfil SE Bond	88.7 ± 0.4^{a}	−3.4 ± 0.1^{b}	17.2 ± 0.4^{b}
Scotchbond Universal Adhesive	88.2 ± 2.4^{a}	−5.1 ± 0.5^{a}	44.9 ± 5.3^{a}

Different superscript lower case letters indicate significant differences considering each coordinate separately ($n = 5$; $p < 0.05$).

CONSIDERAÇÕES FINAIS

O estudo da cor dos materiais dentários é de extrema relevância clínica, visto que a exigência estética dos indivíduos em relação ao seu sorriso tem aumentado exponencialmente nos últimos anos. O comportamento óptico de uma resina composta deveria ser previsível e estável, a fim de proporcionar a obtenção de restaurações com bons resultados estéticos imediatos e em longo prazo.

Todavia, conforme verificado na presente pesquisa, restaurações diretas em resina composta podem ter sua cor imediata comprometida, dependendo do sistema adesivo e da translucidez da resina composta utilizados. Quando uma resina composta com maior translucidez foi utilizada, qualidade necessária a uma adequada estética, o sistema adesivo teve um impacto negativo na cor das restaurações. O sistema adesivo Single Bond Universal apresentou maior tendência ao verde e ao amarelo em comparação aos demais adesivos testados. Em contrapartida, nenhuma diferença estatisticamente significante foi observada entre os sistemas adesivos quando aplicados sobre uma resina composta mais opaca.

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ANEXO – Guidelines for Authors

The Journal of Adhesive Dentistry is a bi-monthly journal that publishes scientifically sound articles of interest to practitioners and researchers in the field of adhesion to hard and soft dental tissues. The Journal publishes several types of peer-reviewed original articles:

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6. Proceedings of symposia, workshops, or conferences – covering topics of relevance to adhesive dentistry and related topics.

7. Letters to the Editor – may be submitted to the editor-in-chief; these should normally be no more than 500 words in length.

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3. One paper copy of the manuscript plus a floppy diskette or CD-ROM (mandatory) containing a PC word file of the manuscript text, tables and legends Figures should be included on the disk if possible in any format that can to be opened using Adobe Photoshop, (TIf, GIf, JPG, PSD, EPS etc.) or as a Microsoft PowerPoint Document (ppt).

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- Title page. The first page should include the title of the article (descriptive but as concise as possible) and the name, degrees, job title, professional affiliation, contribution to the paper (e.g., idea, hypothesis, experimental design, performed the experiments in partial fulfillment of requirements for a degree, wrote the manuscript, proofread the manuscript, performed a certain test, consulted on and performed statistical evaluation, contributed substantially to discussion, etc.) and full address of all authors. Phone, fax, and e-mail address must also be provided for the corresponding author, who will be assumed to be the first listed author unless otherwise noted. If the paper was presented before an organized group, the name of the organization, location, and date should be included.

- 3-8 keywords.

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- Introduction. Summarize the rationale and purpose of the study, giving only pertinent references. Clearly state the working hypothesis.
- Materials and Methods. Present materials and methods in sufficient detail to allow confirmation of the observations. Published methods should be referenced and discussed only briefly, unless modifications have been made. Indicate the statistical methods used, if applicable.
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- All references must be cited in the text, according to the alphabetical and numerical reference list.
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1. Turp JC, Kowalski CJ, Stohler CS. Treatment seeking patters of facial pain patients: Many possibilities, limited satisfaction. J Orofacial Pain 1998;12:61-66.

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1. Hannam AG, Langenbach GEJ, Peck CC. Computer simulations of jaw biomechanics. In: McNeill C (ed). Science and Practice of Occlusion. Chicago: Quintessence, 1997:187-194.

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- All illustrations must be numbered and cited in the text in order of appearance.
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– 83 mm and 300 dpi (for column size).

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