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CENTRO DE CIÊNCIAS BIOLÓGICAS E DA SAÚDE
MESTRADO EM ODONTOLOGIA

Renata Paschoalino de Souza Carreira

EFEITO DO CHÁ VERDE NA RESISTÊNCIA DE UNIÃO DO ESMALTE SUBMETIDO AO TRATAMENTO CLAREADOR CASEIRO

Londrina
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RENATA PASCHOALINO DE SOUZA CARREIRA

EFEITO DO CHÁ VERDE NA RESISTÊNCIA DE UNIÃO DO ESMALTE SUBMETIDO AO TRATAMENTO CLAREADOR CASEIRO

Dissertação apresentada à Universidade Norte do Paraná - UNOPAR, como requisito parcial para a obtenção do título de Mestre em Odontologia, área de concentração Dentística Preventiva e Restauradora.

Orientadora: Profa. Dra. Sandrine B. Berger

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ATA DE DEFESA DE DISSERTAÇÃO

Aos vinte e oito dias do mês de fevereiro do ano de dois mil e doze, no Centro de Ciências Biológicas e da Saúde, desta Universidade, às quatorze horas e trinta minutos, reuniu-se a Banca Examinadora indicada pelo Programa de Pós-Graduação e homologada pelo Colegiado dos Programas Pós-Graduação *Stricto Sensu*, composta por 1. Prof^a. Dr^a. Sandrine Bittencourt Berger, presidente da banca. 2. Prof. Dr. Marcelo Giannini. 3. Prof. Dr. Murilo Baena Lopes. A reunião tem por objetivo julgar o trabalho da aluna ***Renata Paschoalino de Souza Carreira***, sob o título *"Efeito do chá verde na resistência de união do esmalte submetido ao tratamento clareador caseiro"*. Os trabalhos foram abertos pela presidente da banca. A seguir foi dada a palavra à estudante para apresentação do trabalho. Cada examinador arguiu a mestranda, com tempos iguais de arguição e resposta. Terminadas as arguições, procedeu-se o julgamento do trabalho, concluindo a Banca Examinadora de Dissertação por sua ***APROVAÇÃO*** e com a recomendação de envio dos exemplares no prazo de 60 dias, para homologação pelo Colegiado de Pós-Graduação. Nada mais havendo a tratar, foi lavrada a presente ata, que vai assinada pelos membros da Banca Examinadora.

Londrina, 28 de fevereiro de 2012

Examinadores:

Prof^a. Dr^a. Sandrine Bittencourt Berger Sandrine B. Berger

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Prof. Dr. Murilo Baena Lopes Murilo Baena Lopes

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DEDICATÓRIA

Dedico este trabalho ao meu amado e grande incentivador, meu marido Wagner se não fosse por ele possivelmente não teria conseguido realizar este sonho.

Meu grande e eterno amor...

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À Pró-Reitoria de Pesquisa e Pós-Graduação, representada pelo Prof. Dr. Hélio Hiroshi Suguimoto.

Ao Centro de Ciências Biológicas e da Saúde, representado pelo Prof. Ruy Moreira da Costa Filho.

Ao Programa de Pós-graduação em Odontologia, representado pelo Prof. Dr. Alcides Gonini Júnior.

CARREIRA, Renata Paschoalino de Souza. **Efeito do chá verde na resistência de união do esmalte submetido ao tratamento clareador caseiro**. 2012. 39p. Dissertação (Mestrado em Odontologia) Universidade Norte do Paraná, Londrina.

RESUMO

O objetivo deste estudo foi avaliar o efeito antioxidante do chá verde na resistência de união do esmalte clareado. Foram utilizados neste estudo quarenta e dois terceiros molares humanos e estes, foram divididos aleatoriamente em seis grupos experimentais: G1: grupo controle (sem tratamento), G2: clareado (peróxido de carbamida a 10%), G3: clareado + ascorbato de sódio a 10%, G4: clareado + chá verde a 10%, G5: não clareado + ascorbato de sódio a 10% e G6: não clareado + chá verde a 10%. O agente clareador foi aplicado diariamente, por seis horas na superfície do esmalte nos grupos 2, 3 e 4 durante 14 dias. Nas 18 horas remanescentes, os espécimes foram mantidos em saliva artificial a 37°C ± 1°C. O ascorbato de sódio a 10% foi aplicado nos grupos 3 e 5 e o chá verde a 10% foi aplicado nos grupos 4 e 6 por uma hora a 37°C ± 1°C. Imediatamente após os tratamentos, foram realizados os procedimentos adesivos com Adper Single Bond II e Filtek Z350XT (3M-ESPE). Após 24 horas, os espécimes foram seccionados perpendicularmente à interface adesiva e testados em máquina de ensaio universal (EMIC). As interfaces foram preparadas para análise do modo de fratura utilizando microscopia eletrônica de varredura. Os dados foram tabulados e analisados por ANOVA e teste de Tukey ($\alpha = 5\%$). As médias (desvio padrão) dos grupos foram: G1 - 33,22 (5,85) A; G2 - 22,65 (5,54) B, G3 - 30,04 (5,21) AB, G4 - 31,58 (3,76) AB, G5 - 29,13 (4,24) AB; G6 - 32,20 (4,50) A. Com base nos dados obtidos neste estudo, podemos concluir que o chá verde pode ser um antioxidante alternativo para uso antes de procedimentos adesivos no esmalte clareado.

Palavras-chave: Esmalte, Adesão, Clareamento dental

CARREIRA, Renata Paschoalino de Souza. **Bond strength evaluation using green tea on bleached enamel.** 2012. 39p. Dissertation (Master in Dentistry) University of North Paraná, Londrina Londrina.

ABSTRACT

The objective of this study was to evaluate the antioxidant effect of green tea on bond strength to bleached enamel. Forty-two human third molars were randomly divided into six experimental treatment groups: group 1, no treatment (control group); group 2, bleaching (10% carbamide peroxide); group 3, bleaching + 10% sodium ascorbate; group 4, bleaching + 10% green tea; group 5, 10% sodium ascorbate; group 6, 10% green tea. In groups 2, 3 and 4, the bleaching agent was applied to dental enamel surface 6 h daily for 14 days, and specimens were stored in artificial saliva solution during the remaining 18 h of each day. In groups 3 and 5, 10% sodium ascorbate was applied for 1 h; in groups 4 and 6, 10% green tea was applied for 1 h. Immediately after treatment, the specimens were bonded with Adper Single Bond 2 and Filtek Z350 XT (3M ESPE). The specimens were sectioned perpendicular to the adhesive–tooth interface and microtensile bond strengths were measured with a universal testing machine (EMIC; Equipamentos e Sistemas de Ensaio Ltda.). Fracture mode analysis of the bonded enamel surface was performed using scanning electron microscopy. Data were analyzed by one-way analysis of variance and Tukey’s test ($\alpha = 0.05$). Means (standard deviations) of bond strength in MPa were: group 1, 33.22 (5.85)A; group 2, 22.65 (5.54)B; group 3, 30.04 (5.21) AB; group 4, 31.58 (3.76)AB; group 5, 29.13 (4.24)AB; group 6, 32.20 (4.50)A. For all groups were identified a higher percentage of mixed failures. Green tea can be used as an alternative antioxidant on bleached enamel before bonding procedures.

Key-words: Enamel, Adhesion, Dental bleaching

SUMÁRIO

1 INTRODUÇÃO

Haywood and Heymann publicaram o primeiro artigo descrevendo a técnica de clareamento caseiro utilizando o peróxido de carbamida (HAYWOOD & HEYMANN, 1989). Desde então, o uso do tratamento caseiro com o peróxido de carbamida 10% tornou-se amplamente utilizado, e esta, a técnica de escolha para alcançar uma melhor estética em casos de dentes escurecidos e pigmentados. As pigmentações podem ocorrer por vários fatores, desde fatores sistêmicos como ingestão de medicamentos (tetraciclina, fluorose) como também fatores extrínsecos, como alimentação e tratamentos inadequados (WATTS & ADDY 2001; JOINER, 2004).

Outros procedimentos estéticos podem também ser realizados para tratamento de dentes escurecidos, tais como facetas estéticas em dentes anteriores, troca de restaurações antigas com aspecto insatisfatório, fechamento de diastemas e outros procedimentos estéticos. Entretanto, o clareamento é frequentemente associado com procedimentos restauradores em que resina composta ou facetas podem ser necessárias para substituir restaurações antigas, com o intuito de obtenção de uma cor mais aceitável para a conclusão do caso (SWIFT, 1997).

O mecanismo de ação dos agentes clareadores baseia-se em uma reação de oxidação, onde ocorre a liberação de radicais livres de oxigênio quando em contato com a superfície dental (MINOUX & SERFATY 2008). Estes radicais livres são altamente reativos e são capazes de penetrar na estrutura dental através das porosidades dos prismas de esmalte atingindo a dentina e por meio de um processo químico provocam a quebra de moléculas orgânicas e inorgânicas pigmentadas de alto peso molecular em moléculas menores de baixo peso molecular e menos pigmentadas (HAYWOOD et al., 1992; JOINER, 2004). Entretanto, numerosos estudos tem mostrado que o peróxido de carbamida e hidrogênio podem afetar adversamente a resistência de união de compósitos à estrutura dental quando a adesão é realizada imediatamente após o clareamento (DISHMAN et al., 1994; CAVALLI et al., 2001; CAVALLI, et al., 2005). Este processo pode ser atribuído a presença de oxigênio residual que interfere na adesão e inibe a polimerização dos sistemas adesivos, sendo responsável pelo prejuízo na resistência adesiva entre o material restaurador e os substratos dentais (VIDHYA et al., 2011; MCGUCKIN et al., 1992; PERDIGÃO et al., 1998).

Com o objetivo de evitar falhas adesivas na interface material restaurador e superfície dental, um período de espera que varia de 24 horas a 3 semanas é recomendado (TITLEY et al., 1992; CAVALLI et al., 2001; UNLU et al., 2008), uma vez que redução na resistência de união da resina composta ao esmalte ou dentina após o tratamento clareador tem sido demonstrada temporária (MCGUCKIN et al., 1992; UNLU et al., 2008).

Levando em consideração a exigência de tempo de pacientes que, hoje tem necessidades cada vez mais rápidas de tratamentos, em alguns casos fica inviável a espera do tempo recomendado pela literatura. Hoje existem trabalhos consistentes com uso de soluções redutoras ou antioxidantes como: ascorbato de sódio (LAi et al., 2002; TURKUN & KAYA, 2004; TURKUN et al., 2009), extrato de uva (VIDHYA et al., 2011), $\propto$-tocoferol (vitamina E) (SASAKI et al., 2009), catalase, bicarbonato de sódio (TORRES et al., 2006) e solventes orgânicos como etanol (SUNG et al., 1999) e acetona (BARGHI & GODWIN, 1994). Apesar da existência destas alternativas para restabelecer a capacidade adesiva do esmalte clareado, a recomendação mais comum é postergar os procedimentos restauradores (DISHMAN et al., 1994).

Nos últimos anos o chá verde tem sido amplamente estudado em Odontologia. Pesquisas relatam o seu uso na redução da erosão dentária (MAGALHÃES et al., 2009), como agente antimicrobiano (YOO et al., 2011) e na redução da inflamação gengival (MARUYAMA et al., 2011). Entretanto, ainda não foi estudada a sua aplicação como um agente antioxidante após o tratamento clareador.

O chá verde, originário da planta *Cammellia Sinnensis*, contém principalmente flavanóides ou catequinas de epigalocatequina galato (EGCG), epigalocatequina (EGC), epicatequina galato (ECG) e epicatequina (EC) (CHAN, et al., 2011; Horžić D 2009). Estudos relatam que o chá verde apresenta propriedades antioxidantes, e estas são atribuídos às catequinas das EGCG e EGC (KONDO et al., 1999; HORŽIĆ et al., 2009).

Desta forma, o objetivo deste estudo foi avaliar o efeito do chá verde na resistência de união do compósito ao esmalte, imediatamente após o tratamento clareador com peróxido de carbamida a 10%.

2 ARTIGO

Esta dissertação é composta de um estudo em formato de artigo intitulado: "**Evaluation of bond strength with the use of green tea on bleached enamel**". Este artigo será submetido à publicação no periódico ***Operative Dentistry***, cujo fator de impacto em 2010 foi 1.560. O artigo foi formulado de acordo com as orientações gerais para elaboração de manuscritos a serem considerados para publicação na revista (ANEXO 1).

EVALUATION OF BOND STRENGTH WITH THE USE OF GREEN TEA ON BLEACHED ENAMEL

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EVALUATION OF BOND STRENGTH WITH THE USE OF GREEN TEA ON BLEACHED ENAMEL

Running title: Effect of Green Tea on Bleached Enamel

Clinical Relevance: A significant reduction in the bond strength of restorative material to enamel after 10% carbamide peroxide treatment has been reported. The use of green tea as an antioxidant agent may increase bond strength values.

SUMMARY

Objective**:** The objective of this study was to evaluate the antioxidant effect of green tea on bond strength to bleached enamel.

Materials and Methods: Forty-two human third molars were randomly divided into six experimental treatment groups: group 1, no treatment (control group); group 2, bleaching (10% carbamide peroxide); group 3, bleaching + 10% sodium ascorbate; group 4, bleaching + 10% green tea; group 5, 10% sodium ascorbate; group 6, 10% green tea. In groups 2, 3 and 4, the bleaching agent was applied to dental enamel surface 6 h daily for 14 days, and specimens were stored in artificial saliva solution during the remaining 18 h of each day. In groups 3 and 5, 10% sodium ascorbate was applied for 1 h; in groups 4 and 6, 10% green tea was applied for 1 h. Immediately after treatment, the specimens were bonded with Adper Single Bond 2 and Filtek Z350 XT (3M-ESPE). The specimens were sectioned perpendicular to the adhesive–tooth interface and microtensile bond strengths were measured with a universal testing machine. Fracture mode analysis of the bonded enamel surface was performed using scanning electron microscopy. Data were analyzed by one-way analysis of variance and Tukey's test ($\alpha = 0.05$).

Results: Means (standard deviations) of bond strength in MPa were: group 1, 33.22 (5.85)A; group 2, 22.65 (5.54)B; group 3, 30.04 (5.21) AB; group 4, 31.58 (3.76)AB; group 5, 29.13 (4.24)AB; group 6, 32.20 (4.50)A. For all groups were identified a higher percentage of mixed failures.

Conclusions: Green tea can be used as an alternative antioxidant on bleached enamel before bonding procedures.

2.1 INTRODUCTION

Vital tooth bleaching procedures are the most commonly used conservative and effective treatments for discolored teeth.[1] Previous studies have shown that bleaching agents containing 10–35% carbamide or hydrogen peroxide adversely affect the bond strength of composite to acid-etched enamel when bonding is performed immediately after the bleaching procedure.[2,3] Several studies have demonstrated that the reduction in the bond strength of composite applied after bleaching is due to the release of residual oxygen from the bleaching agent, which interferes with resin infiltration into etched enamel and inhibits resin polymerization.[4,5]

Previous studies have proposed the use of a variety of antioxidant agents, such as 10% sodium ascorbate, catalase, peroxidase, glutathione, sodium bicarbonate, and grape seed extract, to reverse the delay bonding.[2,6-8] Among these agents, sodium ascorbate is used most frequently because is neutral, nontoxic, and biocompatible.[2,7,9] Natural antioxidants, such as grape seed extract, contain oligomeric proanthocyanidin complexes with free radical scavenging ability that has been shown to be 50 times more potent than that of sodium ascorbate.[8,10] Vidhya et al.[8] demonstrated significantly higher bond strength values in teeth treated with 5% proanthocyanidin than in those treated with sodium ascorbate.

Although several studies have demonstrated the efficacy of many antioxidants in the reversal of reduced bond strength to bleached enamel, the use of green tea as an antioxidant on bleached enamel has not been investigated. Green tea is made from the *Camellia sinensis* plant and contains mainly flavanols or catechins, such as epigallocatechin gallate (EGCG), epigallocatechin (EGC), epicatechin gallate (ECG), and epicatechin (EC). The strong antioxidant properties of green tea have been attributed to catechins of EGCG and EGC.[11,12]

The current study evaluated microtensile bond strength in human enamel submitted to bleaching treatment with 10% carbamide peroxide, then treated with antioxidants containing 10% sodium ascorbate or 10% green tea.

2.2 MATERIALS AND METHODS

Specimen Preparation and Experimental Groups

This study was approved by the Ethics Committee of the University of North Paraná (protocol PT/0428/10). Forty-two non-carious human third molars that had been extracted for therapeutic reasons and were free from enamel defects were included in this study. The teeth were cleaned thoroughly and refrigerated in a solution of 0.05% thymol for no longer than 2 months after extraction, and were cleaned of gross debris and placed in distilled water for 24 h before beginning the experiment.

The root portion of each tooth was removed 2 mm below the dentin–enamel junction with a diamond saw (Buehler, Lake Bluff, IL, USA), and the coronal portion was sectioned mesiodistally. The samples were then divided into six treatment groups, as shown in Table 1. The enamel specimens were flattened using 600- and 1200-grit Al_2O_3 abrasive paper, cooled under running water, and polished with diamond pastes (3 and 0.5 μm) and felt discs (Arotec, Cotia, SP, Brazil). Between disc and paste applications, the samples were ultrasound washed in distilled and deionized (DD) water for 10 min to eliminate residue. The samples were fixed in an acrylic device and an individual mold was made for each specimen using 0.4-mm-thick flexible polymer in a vacuum plasticizer (P7; BioArt Equipamentos Odontológicos, São Paulo, SP, Brazil).

Bleaching Procedures

For groups 2, 3 and 4, approximately 0.02 ml of bleaching agent (Opalescence; Ultradent, Inc., South Jourdan, UT, USA) was applied to the enamel surface. The individual molds were placed over the specimens and then closed, immersing them in 13.5 ml of artificial solution (pH 7.0) at 37 ± 1ºC for 6 h daily during 14 days. The individual molds were then removed and rinsed with DD water, and the bleaching agents were removed completely from the enamel surfaces by washing with DD water. During the remaining 18 h/day, the specimens were kept in 13.5 ml of artificial saliva solution in individual closed containers at 37 ± 1ºC.

Application of Antioxidant Agents

For groups 3 and 4, approximately 0.02 ml of 10% green tea (Chateaú de D'or, Maringá, Paraná, Brazil) or 10% sodium ascorbate (Chateaú de D'or), respectively, were applied to samples immediately after the above-described bleaching procedures. The individual molds were placed over the samples to prevent the dilution of the antioxidant solution in the artificial saliva, as described by Sasaky et al.[13] The antioxidant agents were used for 1 h at 37 ± 1ºC to neutralize the oxidizing effect of carbamide peroxide. Antioxidant agents were also applied to samples in groups 5 and 6 (Table 1). After 1 h had elapsed, the individual molds were removed and the antioxidant agents were washed from the dental enamel with DD water.

Microtensile Bond Strength Test

After treatments, the samples were etched with 35% phosphoric acid (Scotchbond Etchant Gel; 3M ESPE, St. Paul, MN, USA), bonded using an adhesive system (Single Bond; 3M ESPE) according to the manufacturer's instructions, and light cured (XL3000; 3M ESPE). Three layers of resin composite (Z350; 3M ESPE) were applied to the bonded surfaces to build up a cube-like crown approximately 6.0 mm in height. Each resin layer was light cured for 40 s, and the bonded teeth were stored in water at 37ºC for 24 h.

After storage, the specimens were sectioned perpendicular to the adhesive–tooth interface into 1.0 x 1.0-mm beams using a slow-speed diamond wafering blade (Series 15LC; Buehler) under constant water cooling. Beams obtained from each group were individually fixed in a tensile jig using cyanoacrylate glue (Super Bonder Gel; Loctite, São Paulo, SP, Brazil) and tested to failure using a microtensile machine (EMIC; Equipamentos e Sistemas de Ensaio Ltda., São José dos Pinhais, PR, Brazil) at a speed of 0.5 mm/min with a 50-kgF load cell. The microtensile bond strength values obtained were expressed in MPa.

Fracture Mode Analysis

After debonding, the microstructure of the enamel and resin surfaces was examined under a scanning electron microscope (SEM; JSM-5600; JEOL Ltd., Peabody, MA, USA). Selected debonded specimens from each experimental group were mounted on metal stubs, left to dry for 24 h, sputter coated with gold, and evaluated under the SEM. Fractures were classified as adhesive (lack of adhesion), cohesive in resin/adhesive (failure of resin composite/adhesive), or mixed (both adhesive and cohesive failure).

Statistical Analysis

The data were tabulated and statistically analyzed. The Kolmogorov–Smirnov test was used to verify the normal distribution of the data. Then, the data were compared by one-way analysis of variance (ANOVA) and Tukey's test.

2.3 RESULTS

Table 2 shows the means and standard deviations of microtensile bond strengths for the experimental groups. One-way ANOVA revealed significant differences among the tested groups ($p = 0.0041$). Tukey's test indicated that the microtensile bond strengths of green tea–treated groups (4 and 6) and the control group (1) were significantly higher than that of the bleached group (2). Although microtensile bond strengths were higher in groups treated with 10% sodium ascorbate (groups 3 and 5) than in the bleached group (2), these differences were not significant. Bond strengths differed significantly between the control group (1) and the bleached group (2).

Fracture mode analysis identified a higher percentage of mixed failures than adhesive or cohesive failures in all groups (Figure 1). The Figures 2, 3, 5 and 7 show mixed failure for control group, bleached group, bleached + 10 gren tea and no bleaching + 10% green tea respectively using SEM photomicrograph. The Figures 4 and 6 show cohesive failure for bleached +

10% sodium ascorbate and no bleaching 10% sodium ascorbate respectively. Moreover, in the Figures 3 and 4 areas with porous appearance are observed.

2.4 DISCUSSION

Bleaching agents release free radicals as nascent oxygen and hydroxyl (OH) or peri-hydroxyl ions when they are applied to the dental structure. A free radical is any molecule with one unpaired electron, imparting high reactivity. These molecules are able to react with the electron-rich regions of pigments inside the dental structure, breaking down large pigmented molecules into smaller, less pigmented ones.[14] In this way, the loss of resin adhesiveness to enamel is related to the possible presence of residual peroxide, which interferes with resin attachment and inhibits resin polymerization.[2,4]

This study evaluated the ability of two antioxidants (10% green tea and 10% sodium ascorbate) to reverse the reduction in bond strength after 10% carbamide peroxide bleaching. The results demonstrated a significant reduction in bond strength after bleaching, in agreement with Cavalli et al.'s[4] finding that agents containing 10–20% carbamide peroxide adversely affect the bond strength of composite resin to enamel when bonding is performed immediately after bleaching.[4]

Torres et al.[15] evaluated the effects of six antioxidant agents on the bond strength of enamel submitted to bleaching treatment, and found a significant increase in bond strength in the group treated with catalase. However, none of the antioxidant agents tested was capable of completely neutralizing the deleterious effects of bleaching on bond strength. The same effect was observed in the current study; bond strengths in the groups treated with 10% sodium ascorbate were statistically similar to those in the control and bleached groups.

The current study evaluated green tea as an alternative antioxidant, finding that bond strength values in the green tea–treated group were statistically similar to those in the control group and significantly higher than those in the bleached group. Although bond strength values were higher in the groups treated with sodium ascorbate than in the bleached group, these differences were not significant.

Vidhya et al.[8] tested the use of grape seed extract, a natural antioxidant, on bonding strength to bleached enamel. They found that grape seed extract resulted in significantly greater enamel bond strength than 10% sodium ascorbate. The results of the current study also demonstrated the superior efficacy of green tea, a natural antioxidant, over 10% sodium ascorbate. The use of green tea prior to bonding procedures on bleached enamel completely neutralized the deleterious effects of bleaching and was able to significantly increase the bond strength.

The potent antioxidant activities of catechins in green tea are due to three adjacent OH groups on the B-ring, as in EGCG, GCG, EGC, and GC, which scavenge free radicals more effectively than the two adjacent OH groups, as in ECG, CG, and EC.[12] We speculate that green tea was able to remove residual peroxide, which interferes with resin bonding and inhibits resin polymerization,[1,5] enabling the adhesive procedure to be performed immediately after bleaching.

Using SEM, Titley et al.[16] found that interfaces between resin and bleached enamel differed substantially from those formed between resin and unbleached enamel. Turkun & Kaya[17] reported that SEM examinations of interfaces between resin and bleached enamel displayed a granular and porous aspect, with a bubbled appearance. This appearance has been suggested to be due gaseous bubbling, which could be the result of oxidizing reactions due to the entrapment of peroxide in the enamel subsurface layer. The same porous and granular appearance was also observed in this study (Figure 3 and 4). More adhesive failures than other failure types occurred in the bleaching and immediate bonding group (group 2) in comparison with other groups. This finding may also indicate that bleaching adversely affected enamel bond strength immediately after bleaching and 10% sodium ascorbate did not prevent to pores formation. However, mixed failures were predominant in all groups, in agreement with the findings of Turkun & Kaya.[17]

The groups receiving no bleaching treatment that were treated with 10% green tea (group 4) and 10% sodium ascorbate (group 5) showed bonding strengths similar to those of the control group (group 1). Moreover, bond strength was significantly greater in group 4 than in the bleached group (group 2). These results revealed that the antioxidant agents only had beneficial effects when used after bleaching treatment.

2.5 CONCLUSION

Within the limitations of the present study, treatment with green tea showed satisfactory results in the enamel bond strength and may be another alternative for use immediately after bleaching.

2.6 REFERENCES

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2.7 TABLES

Table 1 – Experimental groups according treatments

Group	Bleaching Agent	Antioxidant
Group 1	No bleaching	No antioxidant
Group 2	10% carbamide peroxide	No antioxidant
Group 3	10% carbamide peroxide	10% sodium ascorbate
Group 4	10% carbamide peroxide	10% green tea
Group 5	No bleached	10% sodium ascorbate
Group 6	No bleached	10% green tea

Table 2 - Mean and standard deviation of microtensile bond strength values.

Experimental Groups	Mean (standard deviation)
Control Group (No bleaching)	33.22 (5.85) A
Bleached	22.65 (5.54) B
Bleached + 10% sodium ascorbate	30.04 (5.21) AB
Bleached + 10% green tea	31.58 (3.76) A
No Bleaching + 10% sodium ascorbate	29.13 (4.24) AB
No Bleaching + 10% green tea	32.20 (4.50) A

Values followed by different letters in column are significantly different between them by Tukey's test ($p<0.05$).

2.8 FIGURES

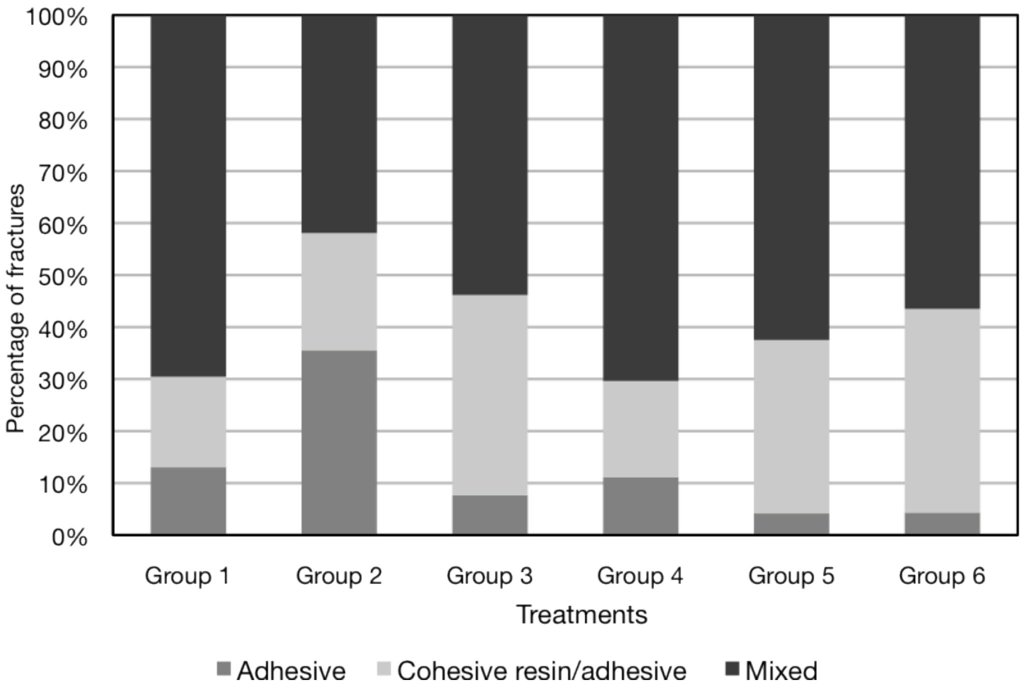

Figure 1 – Fracture mode analysis for groups after microtesile bond strength test.

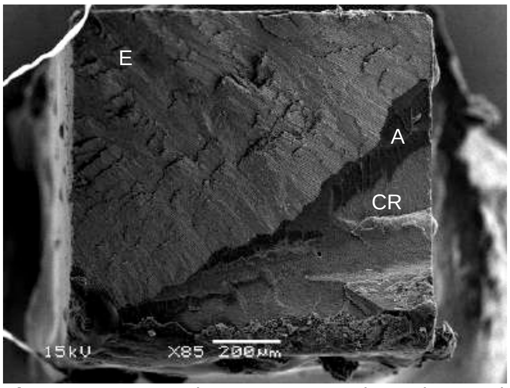

Figure 2 – Control Group. SEM photomicrograph of enamel side of a fractured specimen showing mixed failure. The enamel surface (E) and the remnants of adhesive (A) and composite resin (CR) can be observed.

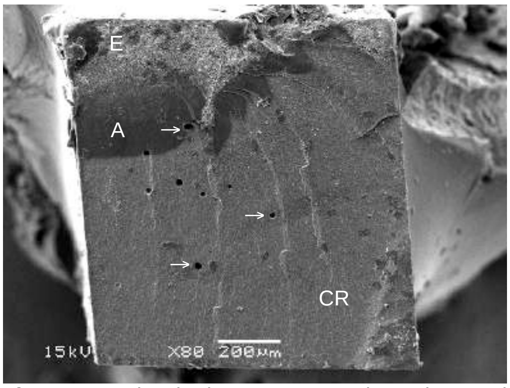

Figure 3 – Bleached Group. SEM photomicrograph of enamel side of fractured specimen showing mixed failure. Besides enamel surface (E), remnants of adhesive (A), composite resin (CR) also can be observed pores (→).

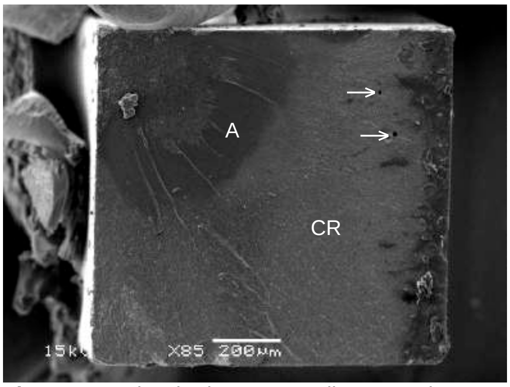

Figure 4 – Bleached + 10% sodium ascorbate. SEM photomicrograph of enamel side of fractured specimen showing cohesive failure. Besides remnants of adhesive (A) and composite resin (CR), also can be observed pores (→).

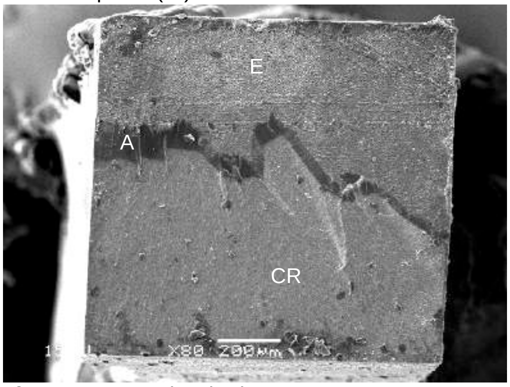

Figure 5 – Bleached + 10% green tea. SEM photomicrograph of enamel side of a fractured specimen showing mixed failure. The enamel surface (E) and the remnants of adhesive (A) and composite resin (CR) can be observed.

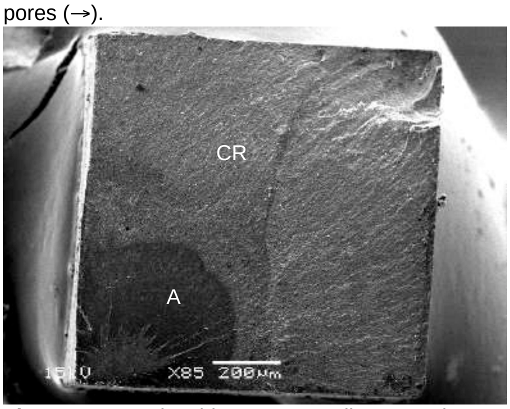

Figure 6 – No Bleaching + 10% sodium ascorbate. SEM photomicrograph of enamel side of fractured specimen showing cohesive failure. The remnants of adhesive (A) and composite resin (CR) can be observed.

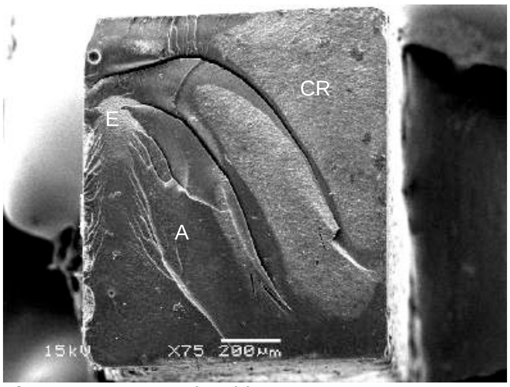

Figure 7 – No Bleaching + 10% green tea. SEM photomicrograph of enamel side of a fractured specimen showing mixed failure. The enamel surface (E) and the remnants of adhesive (A) and composite resin (CR) can be observed.

3 CONCLUSÕES

De acordo com os achados deste estudo, pode-se concluir que o chá-verde foi capaz de reverter a resistência de união imediata do esmalte após o tratamento clareador com peróxido de carbamida a 10%. Entretanto, mais estudos são necessários para avaliar para avaliar a aplicabilidade clínica deste antioxidante.

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ANEXO 1

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   - list of materials used
   - potential problems
   - summary of advantages and disadvantages
   - references (see below)
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  Van Meerbeek B, Vargas M, Inoue S, Yoshida Y, Peumans M, Lambrechts P & Vanherle G (2001) Adhesives and cements to promote preservation dentistry *Operative Dentistry* **(Supplement 6)** 119-144.

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  Yoshida Y, Van Meerbeek B, Okazaki M, Shintani H & Suzuki K (2003) Comparative study on adhesive performance of functional monomers *Journal of Dental Research* **82(Special Issue B)** Abstract #0051 p B-19.
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ANEXO 2

PARECER DO COMITÊ DE ÉTICA EM PESQUISA

UNOPAR

Universidade Norte do Paraná
Comitê de Ética em Pesquisa

PARECER CONSUBSTANCIADO

PROTOCOLO: *PT/0428/10*
RESPONSÁVEL: *Sandrine Bittencourt Berger*
CATEGORIA DE PROJETO: *Pós-Graduação*

O Comitê de Ética em Pesquisa da Unopar analisou e APROVOU quanto ao aspecto ético o projeto **"Efeito da CAMELLIA SINENSIS na resistência de união do esmalte e dentina submetido ao tratamento clareador caseiro."**
O CEP/UNOPAR estabelece:

a) O sujeito da pesquisa tem a liberdade de recusar-se a participar ou de retirar seu consentimento em qualquer fase da pesquisa, sem penalização alguma e sem prejuízo ao seu cuidado (Res. CNS 196/96 – Item IV.1.f) e deve receber uma cópia do Termo de Consentimento Livre e Esclarecido, na íntegra, por ele assinado (Item IV.2.d).

b) O pesquisador deve desenvolver a pesquisa conforme delineada no protocolo aprovado e descontinuar o estudo somente após análise das razões da descontinuidade pelo CEP/UNOPAR (Res. CNS Item III.3.z), aguardando seu parecer, exceto quando perceber risco ou dano não previsto ao sujeito participante ou quando constatar a superioridade de regime oferecido a um dos grupos da pesquisa (Item V.3) que requeiram ação imediata.

c) O CEP/UNOPAR deve ser informado de todos os efeitos adversos ou fatos relevantes que alteram o curso normal do estudo (Res. CNS Item V.4). É papel do pesquisador assegurar medidas imediatas adequadas frente a evento adverso grave ocorrido (mesmo que tenha sido em outro centro) e enviar notificação ao CEP/UNOPAR junto com seu posicionamento.

d) Eventuais modificações ou emendas ao protocolo devem ser apresentadas ao CEP/UNOPAR de forma clara e sucinta, identificando a parte do protocolo a ser modificada e suas justificativas.

e) Semestralmente devem ser encaminhados relatórios parciais e ao término do projeto o relatório final.

Londrina, 22 de fevereiro de 2011.

Prof. Dr. Hélio Hiroshi Suguimoto
Presidente do C.E.P. UNOPAR

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