ANALYSIS OF SURFACE ROUGHNESS OF HUMAN ENAMEL EXPOSED TO BLEACHING AGENT AND SUBMITTED TO BRUSHING

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ABSTRACT

The aim of this study was to assess in vitro the surface roughness (Ra) of human enamel exposed or not exposed to the action of a bleaching agent containing 10% carbamide peroxide (CP) after brushing with different dentifrices. Ninety-six human enamel specimens were divided into 2 groups: GI – exposed to the action of 10% CP; GII – not exposed. These were subdivided into 4 brushing subgroups: (CEW) Close-Up Extra Whitening, (CUB) Colgate Ultra Branco, (CCP) Crest Cavity Protection and (DW) Deionized Water. The specimens from Group GI were exposed to 10% CP for 6 hours/14 days and those from Group GII were stored in artificial saliva for 14 days. Then they were submitted to 35.600 brushing cycles. Ra was measured before and after brushing. Ra difference was compared by two-way ANOVA. Ra was compared between subgroups using ANOVA and Tukey's test. Ra was compared between groups using T-test (α=0.05). Final and initial Ra were compared by Paired t-test; using SPSS (15.0). Two-way ANOVA difference in the outcome revealed that the use of bleaching agent did not affect the difference in Ra (p = 0.45). Brushing significantly influenced the difference in Ra (p <0.001), but the interaction between the two factors was not significant (p = 0.20). Among the brushing subgroups, a significant increase in Ra was observed for Subgroup CEW – GI: Rai 0.691 (0.112)a, Raf 0.993 (0.264)a; Raf-Rai: 0.303a(43.7%) – G2: Rai 0.794(0.167)a, Raf 1.006(0.488)a; Raf-Rai: 0.212a (26.7%) with a statistical difference for Subgroup CUB – GI: Rai 0.639 (0.163)a, Raf 0.506 (0.113)b; Raf-Rai: -0.133b(-20.8%) – GII: Rai 0.647(0.166)a, Raf 0.472b(0.260); Raf-Rai: -0.134b(-0.27%). Regardless of whether or not the enamel had been exposed to 10% CP, Ra values varied according to the abrasives in the composition of the different dentifrices.

Key words: dental enamel, bleaching agent, dentifrices.

ANÁLISE DA RUGOSIDADE SUPERFICIAL DO ESMALTE HUMANO EXPOSTO AO AGENTE CLAREADOR E SUBMETIDO À ESCOVAÇÃO

RESUMO

O objetivo deste trabalho foi avaliar in vitro a rugosidade superficial média (Ra) do esmalte humano exposto ou não à ação de agente clareador com peróxido de carbamida (PC)10% após escovação com diferentes dentifrícios. Foram utilizados 96 espécimes de esmalte divididos em 2 grupos: GI- exposto à ação de gel clareador e GII- não exposto à ação de gel clareador e subdivididos em 8 subgrupos de escovação: (CEW) Close-Up Extra Whitening, (CUB) Colgate Ultra Branco, (CCP) Crest Cavity Protection e (AD) Água Deionizada. Os espécimes do grupo GI foram submetidos ao tratamento clareador com PC10% por 6h/14 dias; os do grupo GII ficaram armazenados em saliva artificial por 14 dias. Decorrido este período, os grupos foram submetidos à 35.600 ciclos em máquina de escovação mecânica que corresponde a 2 anos e meio de escovação normal, utilizando escova Oral-B. A Ra foi medida antes e depois da escovação com um Rugosímetro Mitutoyo SJ 201P. A diferença da Ra foi comparada pela ANOVA bifatorial. A Ra dos subgrupos foi comparada pela ANOVA e pelo Teste de Tukey. A Ra dos grupos foi comparada pelo Teste-T(α=0.05) e a comparação entre a Raf x Rai foi realizada pelo Teste-T Pareado. O software utilizado foi o SPSS 15.0 (Statistical Package for Social Sciences). Os resultados de ANOVA bifatorial do desfecho diferença de rugosidade revelaram que o fator grupo não afetou a diferença de Ra (p=0.45). O fator subgrupo influenciou significamente a diferença de Ra (p<0.001), porém a interação entre ambos fatores não foi significativa (p=0.20). Entre os subgrupos de escovação pode-se observar um aumento significativo da rugosidade para o subgrupo CEW (Rai 0.691; Raf 0.993) com diferença estatística para o subgrupo CUB(Rai 0.639; Raf 0.506). Esses resultados estão relacionados com os diferentes abrasivos presentes na composição dos dentifrícios uma vez que a abrasividade do dentifrício depende da dureza, forma, tamanho, amplitude da distribuição e concentração das partículas.

PalavrasChave: Esmalte Dental, Agentes Clareadores, Dentifrícios.

INTRODUCTION

Over the last few years, patients have been increasingly concerned about dental esthetics because they wish to have healthy, attractive teeth, for which they use cosmetic products directly available on the market or seek clinical treatments in aesthetic dentistry. Tooth bleaching is a popular treatment, which is widely advertised in the media and affordable to patients. As a result, new products with alleged bleaching action are constantly released on the market, claiming to improve the appearance of the smile when it has color alteration.

Tooth color may be altered by the combination of extrinsic and intrinsic staining substances that come into contact with the tooth structure. Since tooth bleaching is a conservative treatment, it is considered as a first choice among alternative treatments in aesthetic dentistry. Extrinsic stains are usually the result of surface precipitation of coloring agents and pigments in the diet (black tea, coffee, red wine) or habits (smoking) on the acquired film of enamel[1-3], whereas intrinsic stains are determined by the layer of dentin underlying the enamel surface, which becomes discolored as a result of fluorosis, trauma, use of antibiotics, systemic conditions and natural aging of teeth[3,4]. To remove these stains, teeth can be bleached with bleaching agents and/or bleaching dentifrices, which have different action mechanisms.

The most popular dental bleaching method is the supervised home technique which uses 10% carbamide peroxide as a bleaching agent to remove both intrinsic and extrinsic stains. This bleaching agent is very unstable, and when it comes into contact with the tissues and saliva, it dissociates into 3% hydrogen peroxide and 7% urea. Urea degrades to ammonia and carbon dioxide, while hydrogen peroxide breaks down easily into water and oxygen, penetrating into the enamel and dentin, promoting dental bleaching[5] However, the effects of bleaching agents on dental structures are still controversial because some studies have shown no significant change [6-12], while others conclude that bleaching agents cause significant morphological changes, which range from changes in the mineral content to changes in surface roughness and micro hardness of the dental structure [13-17]. Despite these controversies, it is known that if changes occur in the surface roughness of the structure, they may contribute to the appearance of extrinsic stains and plaque accumulation, which is reflected by mineral loss and inflammation of the gingival tissues[18].

Another option that has become popular is the use of dentifrices with supposed bleaching action, which may be purchased at supermarkets and drugstores. It is known that these bleaching dentifrices in some way promote dental bleaching by removing and/or controlling extrinsic stains on the tooth surface through the abrasion process[1,2]. The following abrasive agents are typically found in these bleaching dentifrices: hydrated silica, calcium carbonate, dicalcium phosphate dihydrate (DCPD), calcium pyrophosphate, alumina, sodium bicarbonate and perlite[3,4,19]. The abrasiveness of dentifrices depends on particle hardness, shape, size, distribution range and concentration[20-23]. However, this abrasiveness needs to be moderate in order not to cause damage to hard and soft tissues[24].

From the above information and consultation of current scientific literature, it can be seen that there is little information about the effect of dentifrices on the surface roughness of human enamel, exposed or not to the action of home-use bleaching agents. Thus, this study aimed to evaluate *in vitro* the surface roughness (Ra) of human enamel exposed or not the action of the bleaching agent carbamide peroxide (CP) 10%, after brushing with different dentifrices.

Table 1: Dentifrices assessed and their abrasive systems.

Dentifrices	Code	Abrasive system
Close-up extra whitening	CEW	Calcium carbonate, perlite and silica.
Colgate ultra branco	CUB	Calcium carbonate, bicarbonate of soda, aluminum and sodium silicate.
Crest cavity protection	CCP	Silica

MATERIAL AND METHODS

Experimental Design (Table 1): The factor under study was the action of two bleaching dentifrices - Close-Up Extra Whitening (CEW) and Colgate Ultra Branco (CUB), a conventional dentifrice - Crest Cavity Protection (CCP) - positive control, and Deionized Water (DW) - negative control – on the average surface roughness of human enamel either exposed to the action of a bleaching agent containing 10% carbamide peroxide (CP) – Opalescence (Ultradent Product Inc, Salt Lake City, Lot:C129), or not. We used 96 human enamel specimens from 48 healthy third molars, recently extracted for orthodontic reasons, showing no surface changes due to trauma during the extraction, obtained from the Human Permanent Tooth Bank at UFSM.

They were divided randomly into 2 groups: Group I – exposed to the action of a bleaching agent with 10% CP and Group II – not exposed. Each of these groups were subdivided into 4 brushing subgroups according to the dentifrice or deionized water used (control) (Table 2). The response variable was Ra, determined through a read-out made with a roughness meter.

Table 2: Division of groups studied.

Brushing subgroups	Group I (n=48) Bleached	Group II (n=48) Not bleached
Close-Up Extra Whitening (CEW)	Subgroup 1 (n=12)	Subgroup 5 (n=12)
Colgate Ultra Branco (CUB)	Subgroup 2 (n=12)	Subgroup 6 (n=12)
Crest Cavity Protection (CCP)	Subgroup 3 (n=12)	Subgroup 7 (n=12)
Deionized water (DW)	Subgroup 4 (n=12)	Subgroup 8 (n=12)

Selection and preparation of the enamel specimens

Forty-eight extracted healthy human third molars were selected, from which 96 dental enamel specimens were obtained. The teeth were cleaned with Gracey type curettes (Newmar Surgical Instruments- São Paulo - SP - Brazil), pumice stone and water, applied with a Robinson brush (Microdont - São Paulo - SP- Brazil). After cleaning, the teeth were submitted to a sterilization process in a humid medium. The teeth were stored in saline solution at 5°C until the beginning of the study. To prepare the specimens, the sites for the longitudinal and cross sections were marked with graphite on the vestibular and/or lingual surfaces of the crowns. Sections measuring 5 x 5 x 2mm were cut from the flattest area of the crown (middle third), using a double-faced diamond disk (KG Sorensen- Cotia - SP- Brazil) driven by a handpiece at low speed with water irrigation. After this, the specimens were flattened with 600-grit abrasive paper on the side composed of dentin so that all the specimens had the same thickness. After preparation, the specimens were measured using a digital pachymeter. They were polished with 6-8 µm extra-thin polishing paste (Diamond- FGM - Joinvile - SC- Brazil), applied with a sandpaper disk and stored in deionized water up to the time they would or would not be bleached.

Exposure to a bleaching agent, or not

The specimens in Group I (n= 48) were exposed to the action of 10% CP gel (Opalescence). A template corresponding to one drop of the bleaching gel was made so that all the specimens received the same amount of bleaching agent. The gel was applied on a glass slide, superimposed on the template. The specimens were placed on the bleaching gel and stored in plastic containers, covered with gauze dampened in deionized water, and remained in an oven at 37ºC for 6 hours, for 14 days[15]. Then they were washed with deionized water for 10 seconds and stored in artificial saliva at 37ºC, simulating a complete home-bleaching treatment[9,15].

The specimens from Group II (n = 48) were stored in individual containers, duly identified, in artificial saliva at 37ºC for 14 days during bleaching treatment.

Brushing procedure

To perform brushing, a brushing device was devised by the Department of Operative Dentistry of the Dentistry Course at UFSM (Fig, 1) and designed and developed at the Mechanical Engineering course at UFSM. The machine consisted of a motor that produced back-and-forth movements of 10 arms by means of pulleys, onto which the toothbrushes were fixed. Oral-B Indicator Plus 40 (Gillete do Brasil Ltda, Manaus-AM) soft-bristle toothbrushes were used. The machine was set up to run a 3.8 cm horizontal course on the tooth, applying a 200g axial load. A cycle was understood to be a complete back-and-forth movement of the toothbrush. In each brushing procedure, 10 toothbrushes were used, which were changed halfway through the complete brushing cycle in order to avoid the influence of toothbrush bristle wear on the result. For brushing, the enamel specimens were fixed in acrylic resin at the base of the brushing machine, so that they would be prominent, allowing better action of the toothbrush bristles.

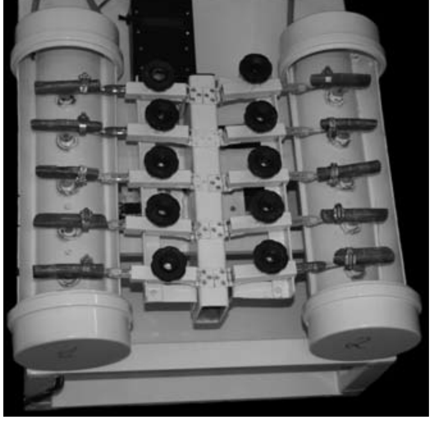

Fig. 1: Mechanical brushing machine UFSM.

The base where the specimens were fixed to the machine was turned 90º in the middle of the cycle so that brushing could be performed in two directions. The application of the Dentifrice was applied in the form of a suspension of toothpaste in deionized water in the proportion of 1:1[25]. The paste formed by toothpaste diluted in deionized water was injected manually every 1 minute. After the tests were concluded, the specimens were removed from the brushing machine and immediately washed with jets of deionized water and stored in artificial saliva at 37ºC.

Surface Roughness Analysis

Average surface roughness (Ra) of each enamel specimen was analyzed using a digital roughness meter (Mitutoyo Surftest SJ-201P). To perform the roughness readout, the diamond point of the roughness meter would run on the specimens at a constant speed of 0.25mm/s and force of 4mN. The cut-off value was adjusted to act at 0.25 µm and surface roughness was characterized by the arithmetical average of surface peak and valley heights found within a central line along the area assessed (Ra), in micrometers (µm). Five readings were performed on each specimen in different directions. The average of these readings was used for the statistical analysis.

The initial Ra reading (Rai) was performed 24 hours after exposure (Group I) to the bleaching agent, or not (Group II). 24 hours after the Rai reading, the brushing procedures began and at the end of this stage, the specimens were stored for 24 hours in artificial saliva and the final Ra reading (Raf) was performed.

Statistical Analysis

Ra difference was compared by two-way ANOVA. Subgroup Ra was compared by ANOVA and Tukey's test. Group Ra was compared by T-test (α=0.05), Comparison between final versus initial Ra was done by Paired t-test

Scanning Electronic Microscopy (SEM)

With the purpose of visualizing and illustrating the results, a SEM of the specimens of each subgroup chosen randomly after brushing was performed. The microscopies that were most representative of the results were selected, since it was not the aim of this study to perform SEM analysis. To perform SEM, the selected enamel specimens were dehydrated and submitted to the metallization process with gold-palladium alloy. The images were captured at 500X magnification and observed under a Scanning Electronic Microscope JEOL A110 (Figs. 2-9).

RESULTS

Two-way ANOVA difference in the outcome revealed that the Ra factor Group (exposure or not to bleaching agent) did not affect the difference in Ra (F= 0.57; p = 0.45). The subgroup factor (brushing) significantly influenced the difference in Ra (F= 12.37; p <0.001), but the interaction between the two factors was not significant (F=1.54; p = 0.20).

Table 3 shows the differences in Rai and Raf in Groups I and II for each brushing subgroup. In both groups, there was a statistically significant increase in Ra for the CEW dentifrice subgroup. For the

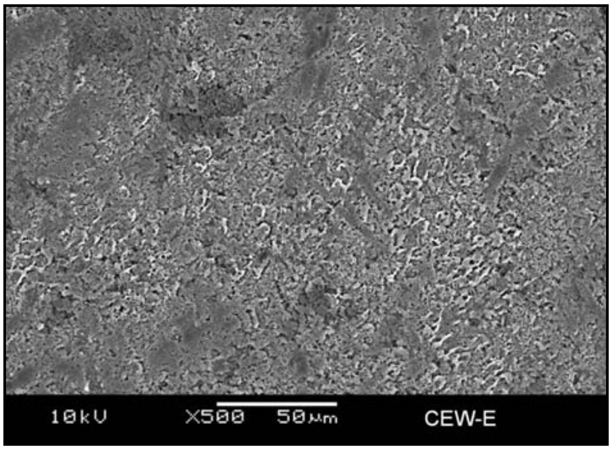

Fig. 2: Image obtained by SEM of the surface micromorphology of enamel exposed (E) to the action of the bleaching agent and brushed with CEW dentifrice.

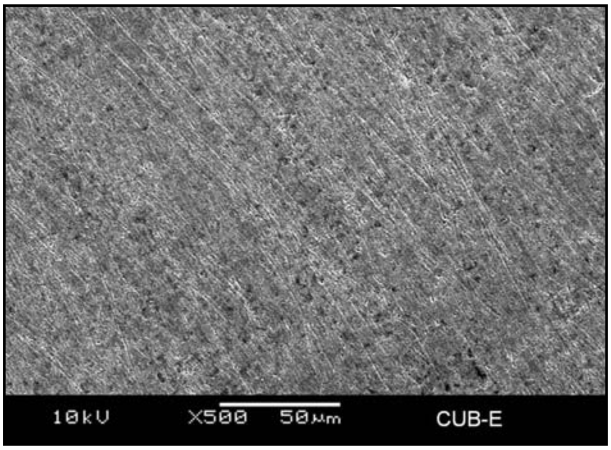

Fig. 3: Image obtained by SEM of the surface micromorphology of enamel exposed (E) to the action of the bleaching agent and brushed with CUB dentifrice.

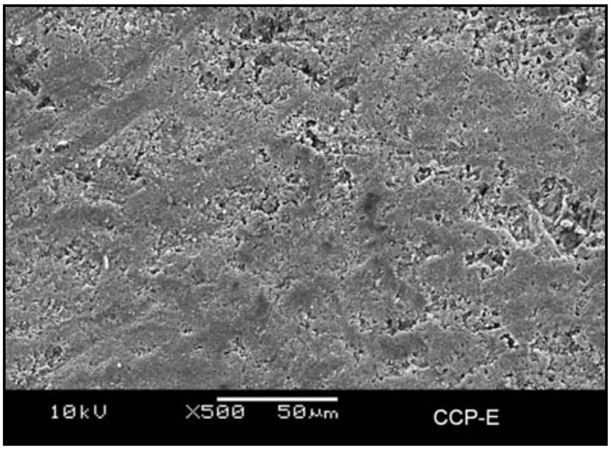

Fig. 4: Image obtained by SEM of the surface micromorphology of enamel exposed (E) to the action of the bleaching agent and brushed with CCP dentifrice.

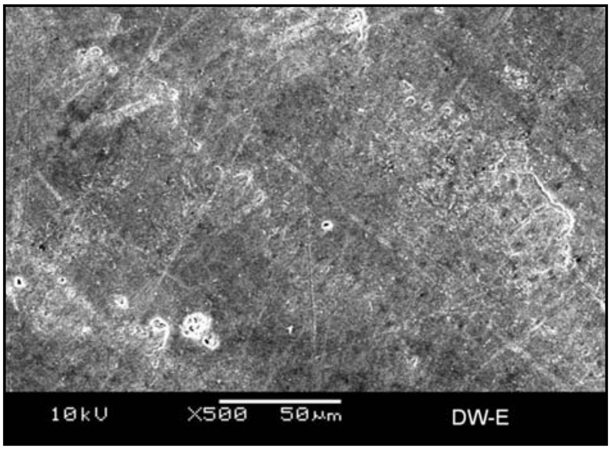

Fig. 5: Image obtained by SEM of the surface micromorphology of enamel exposed (E) to the action of the bleaching agent and brushed with DW.

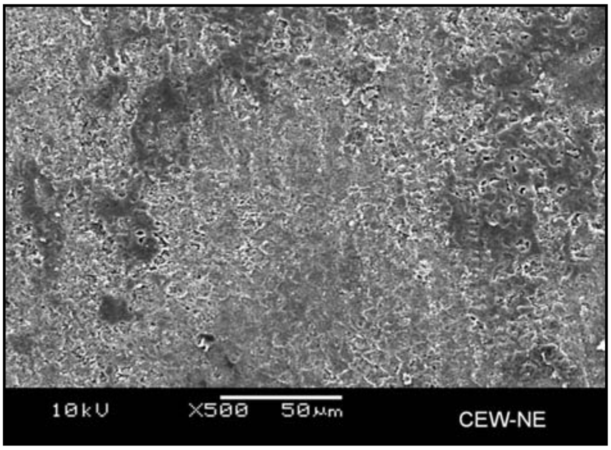

Fig. 6: Image obtained by SEM of the surface micromorphology of enamel not exposed (NE) to the action of the bleaching agent and brushed with CEW dentifrice.

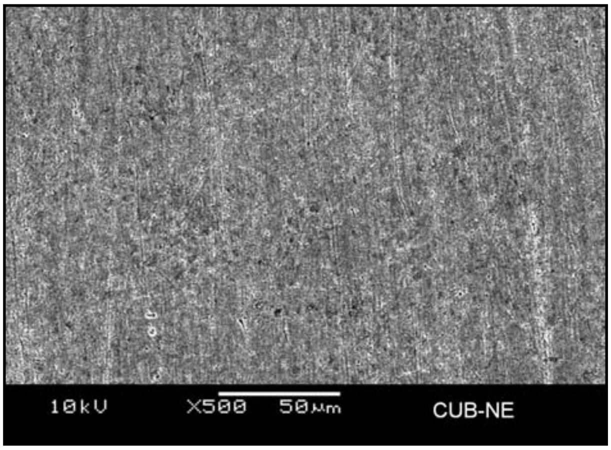

Fig. 7: Image obtained by SEM of the surface micromorphology of enamel not exposed (NE) to the action of the bleaching agent and brushed with CUB dentifrice.

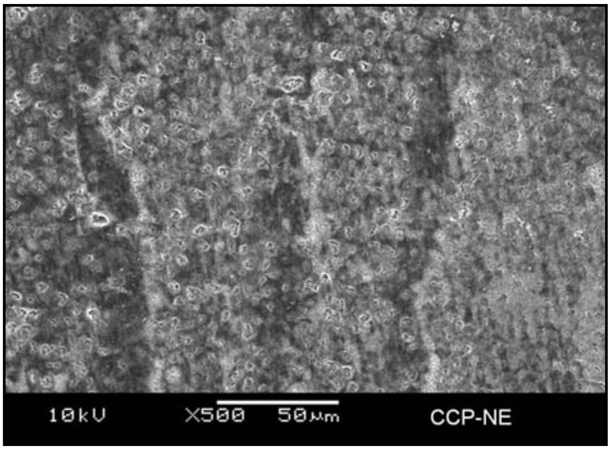

Fig. 8: Image obtained by SEM of the surface micromorphology of enamel not exposed (NE) to the action of the bleaching agent and brushed with CCP dentifrice.

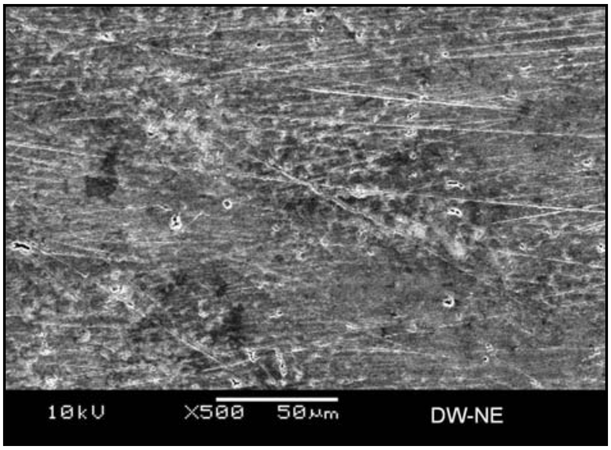

Fig. 9: Image obtained by SEM of the surface micromorphology of enamel not exposed (NE) to the action of the bleaching agent and brushed with DW.

other brushing subgroups, no statistically significant alteration in Ra was observed. For Groups I and II, within each brushing subgroup, no statistically significant difference in Ra was found (capital letters on the horizontal line). No statistically significant difference in Rai was found among the brushing subgroups. Similar results were observed both for Raf and difference in Ra (lowercase letters in the vertical column). CEW is statistically different from CUB; in turn, CCP and DW did not differ statistically from the other brushing subgroups.

In the images obtained by SEM (Figs. 2-9) it was possible to observe alterations in surface micromorphology of enamel exposed, or not, to the action of the bleaching agent and brushed with different dentifrices and deionized water, which were consistent with the results of this study. The results can be observed in differences of the surface micromorphology of the specimens shown in Figs. 2 and 3 of GI (rough appearance) and in Figs. 6 and 7 of GII (smoothness / polishing characteristics).

DISCUSSION

This study tested the effect of brushing with different dentifrices on average surface roughness of human enamel either exposed or not exposed to the action of a bleaching agent with 10% carbamide peroxide.

Statistical analysis of the values obtained for Ra showed that the behavior of the different brushing subgroups was the same. Whether or not the enamel had been exposed to the bleaching agent did not influence the difference in Ra obtained after the action of the different dentifrices. Therefore, the performance of each brushing subgroup will be discussed separately.

It was found that the different dentifrice formulations had different effects on the surface roughness of enamel. This could be related to the different abrasives present in their compositions, which is supported by the study by Pickles[22], who reported that abrasiveness of the dentifrice depends on particle hardness, shape, size, distribution range and concentration. Camargo *et al.* [21] demonstrated that the larger the size of the abrasive particles, the greater is the abrasiveness of the dentifrice. However, different types of abrasives with similar particle sizes present different abrasiveness values. According to these authors, this difference in abrasiveness may be attributed to the difference in hardness of the abrasive particles. With regard to the shape of the abrasive particles, Ashmore *et al.*[26] observed that dentifrices that contain calcium carbonate in their composition, in more regular oval or rhombohedral shape, were less abrasive than those with more irregular aragonite particles. Davis and Winter[27] showed that dentifrices that contain fine particles, such as calcium carbonate and silica, are less abrasive than those with rougher particles.

Two dentifrices with alleged bleaching action, Close-up Extra Whitening (CEW) and Colgate Ultra Branco (CUB) and one regular dentifrice, Crest Cavity Protection (CCP) were assessed. The regular dentifrice CCP has only silica as an abrasive component, while the other dentifrices contain different abrasives in their compositions. The dentifrice CUB has calcium carbonate, aluminum, bicarbonate of soda and sodium silicate as abrasives, and in its composition the dentifrice CEW has abrasives of the calcium carbonate, perlite and silica type. Perlite is a natural volcanic glass with flat glass-shaped particles and sharp cutting edges. While in use under load, the abrasive particles are broken down and the cutting edges become rounded and rhomboid. The perlite particles thus remain parallel to the tooth surface, reducing the potential for scratches on the surface and increasing their polishing capacity. The use of perlite as an abrasive is common in prophylactic pastes, which are excellent stain removers, combined with good polishing properties and low abrasiveness[28,29].

Table 3 shows that there was a statistically significant increase in enamel Ra only for the brushing subgroup CEW, possibly due to the presence of the perlite abra-

Table 3: Mean surface roughness values (Ra) for Groups I and II, before (Rai) and after (Raf) brushing with each subgroup.

	Group I			Group II		
Brushing subgroups	*Rai (±dp)*	*Raf (±dp)*	*%*	*Rai (±dp)*	*Raf (±dp)*	*%*
CEW	0.691(0.112)b	0.993(0.264)a	43.7	0.794(0.167)b	1.006(0.488)a	26.7
CUB	0.639(0.163)a	0.506(0.113)a	-20.8	0.647(0.166)a	0.472(0.260)a	-0.27
CCP	0.735(0.170)a	0.764(0.224)a	3.9	0.724(0.303)a	0.771(0.165)a	6.5
DW	0.789(0.201)a	0.814(0.419)a	3.2	0.684(0.217)a	0.616(0.164)a	-9.9

The means followed by the same lowercase letter do not significantly differ according to Tukey's test ($p<0.05$).

sive in its composition. For Lutz *et al.*[28], the increase in enamel roughness, after polishing with prophylactic pastes containing perlite can be explained by the performance of the particle through the process of rounding by disintegration or change in the direction of the abrasive particles under load Kuroiwa *et al.*[30], showed that abrasive dentifrices caused light abrasion of enamel and microwear, which may change the surface layer of enamel, exposing the enamel prisms and creating a "new" surface, and this new surface could be related to the increase in roughness for CEW in this study. Table 4 shows that CEW dentifrice with perlite did not differ statistically from CCP with silica and DW, which partly agrees with the findings of Joiner *et al.*[31] and Joiner *et al.*[32], who found that for the level of enamel wear, there was no statistical difference between dentifrices with perlite and silica after twelve weeks *in situ* with *ex vivo* brushing, while in this study, brushing time was equivalent to two and a half years. The study by Lutz *et al.*[28], who observed that there was no statistical difference in roughness between the prophylactic paste with perlite and water, also matches the results of this study.

Moreover, according to Table 4, it can be verified that the brushing subgroup CEW showed an increase in Ra, which differed statistically from CUB. This difference may be related to the wear dynamics of perlite, previously mentioned by Lutz et al. [28], as well as distinct Mohs hardness values of the abrasive particles in their different combinations. If the enamel hardness is taken into consideration (Mohs hardness 5 to 8)[33], and compared to the composition of different dentifrices, it is observed that the CUB dentifrice has alumina-type abrasive in its composition, which is considered an abrasive particle with a high Mohs hardness value of 9.25. Other abrasives such as calcium carbonate, sodium bicarbonate and sodium silicate, derived from silica, have Mohs hardness ranging from 2.5 to 5[20], while the CEW dentifrice has abrasives such as calcium carbonate, with Mohs hardness of 3, silica and perlite with Mohs hardness from 5.5 to 7[29], closer to that of enamel. It can be assumed that the combination of different abrasives in the composition of dentifrices, with different Mohs hardness values, may have contributed to the findings of this study. According to Wülkinitz [34], the mixture of different abrasives may result in different patterns of cleaning/abrasion, differently from when they are used individually. Furthermore, the addition of polishing abrasives such as alumina, present in CUB, with other abrasives, generates an increase in cleaning power. According to Meyers et al. [19], some abrasives are capable of producing a highly polished, smooth surface, but when doing so, they cause a large amount of dental loss. Thus, both a polished surface and a rough surface may be a sign of a worn tooth surface, which could be observed in this study when the enamel was exposed to the action of CUB and CEW dentifrices, respectively.

In this study, it was also found that abrasion can be caused by other factors not related to the dentifrices, which were mentioned by Newbrun[20], such as the hardness of the toothbrush bristles and the pressure applied and the frequency of brushing, since the subgroup brushed with deionized water was statistically similar to subgroups brushed with dentifrices. Because of this, these factors were standardized by applying a 200g axial load to simulate the force used during oral hygiene procedures[24,25]. A rev-counter recorded 35.600 cycles, for 160 minutes, corresponding to 2 ½ years of normal brushing. The corresponding brushing time is based on Joiner et al. [35], who reported that each tooth surface was brushed for 5 seconds twice a day.

Considering the methodology applied, the results of this study indicated that regardless of whether or not the enamel had been exposed to bleaching agent for home use with 10% carbamide peroxide, the performance observed in the different brushing subgroups resulted in different Ra values. Moreover, it may observed that the type, shape, size and hard-

Table 4: Comparison of the values of Rai, Raf and respective Ra differences between each brushing subgroup in Groups I and II.

	Group I (bleached)				Group II (not bleached)			
Brushing subgroups	*Rai (±dp)*	*Raf (±dp)*	*Difer.*	*%*	*Rai(±dp)*	*Raf(±dp)*	*Difer.*	*%*
CEW	0.691(0.112)a	0.993(0.264)a	0.303Aa	43.7	0.794(0.167)a	1.006(0.488)a	0.212Aa	26.7
CUB	0.639(0.163)a	0.506(0.113)b	-0.133Ab	-20.8	0.647(0.166)a	0.472(0.260)b	-0.174Ab	-0.27
CCP	0.735(0.170)a	0.764(0.224)ab	0.029Aab	3.9	0.724(0.303)a	0.771(0.165)ab	0.048Aab	6.5
DW	0.789(0.201)a	0.814(0.419)ab	0.025Aab	3.2	0.684(0.217)a	0.616(0.164)b	-0.067Aab	-9.9

The means with the same lower case letters in the vertical and capital letters in the horizontal do not significantly differ according to Tukey's test ($p < 0.05$).

ness of the abrasive particles are fundamental for the correct choice of dentifrice, but the information present on the packages of these products indicate only the abrasive present in the formula. This reinforces the need for further studies on the composition of the dentifrices, so that professionals can recommend the rational use of dentifrices according to the specific needs of each patient.

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