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ANALYSIS OF ROUGHNESS AND LOSS OF MASS OF COMPOSITE RESIN POSTED A MERGER OF TWO GEL CARBAMIDE PEROXIDE

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ABSTRACT

The aim of this study was to evaluate the surface roughness and mass loss of a microhybrid composite subjected to the action of bleaching agents: carbamide peroxide 10% and 16%. 30 specimens were divided into 3 groups made up: in G1 was not applied product, the G2 was used 10% carbamide peroxide and carbamide peroxide G3 16%, both for 14 days. Data roughness after application were analyzed using "t" test. Was not observed in the microhybrid composite resin, statistically significant differences in roughness. Thus, as the weight of "t" paired two concentrations of carbamide peroxide test were able to induce weight loss. In conclusion, the bleaching agents cause mass loss of the composite resin.

KEYWORDS: Roughness, bleaching agents, carbamide peroxide.

1. INTRODUCTION

In modern dentistry, patients seek more and more, aesthetics in dental offices. The composite has evolved and has been responsible for providing high quality restorations. Another highly sought treatment has been the home bleaching, supervised by a dentist. Among the most commonly used gels for bleaching has been carbamide peroxide on their different concentrations. In much of the treatment plans there is an association of home whitening with subsequent replacement of composite resin restorations.

Tooth bleaching is one of the most accomplished treatments in dental offices to improve the appearance of the smile. This procedure, relatively simple and low cost, is inconvenient the fact that the dentist can not guarantee the patient the desired whitening result. It is therefore important that the professional alert the patient that he is offering a dental whitening procedure, and not exactly a good bleaching result, which can not be guaranteed. For the success of bleaching treatment, it is important to have knowledge of the origin of tooth darkening, ie diagnose the etiology of color change, understand and master the different bleaching products, techniques and their effects on the structure and dental tissues. The procedure consists of applying a bleaching gel based on carbamide peroxide or hydrogen on the teeth to be whitened. Depending on the recommended technique, this procedure can be performed in the office or by the patient, changing the parameters of concentration and time of use[1].

Initially in the industry of dental materials, with the production of composites nanohybrid with an average size of inorganic particles between 100 nanometers to 0.7 microns (1 micron equals 1.000 nanometers). Recently, from 2003 until today, in Brazil, nanoparticulate resins are produced with 100% of nanoscale inorganic particles in the range 20-75 nanometers. We could classify the current composite on the size of inorganic particles: conventional resins or micro particles with an average size comprised load 8 to 15 microns (absent in the market). Resin microparticles from 0.04 to 0.4 micrometers. Hybrid Resins with an average size from 0.04 to 5 micrometers. Composites microhybrids with 0.04 to 0.7 micrometers. Still nanohybrid resins, which are added to microhybrids nanoparticles approximately less than one hundred nanometers to 0.7 microns larger particles; and finally nanoparticulate resins containing nanoparticles 100% all below 100 nm, usually between 20 to 75 nm[2].

The composite resin restorations associated with previous dental whitening, present themselves as more aesthetic restorative treatment option for patients with anomalies of dental form. The use of composites by direct technique in anterior teeth is an alternative able to meet the aesthetic requirements of the patient. His association with the tooth whitening allows the professional

and patient clinical outcome favorable, increasing the value and the brightness of the enamel[3].

Liberato *et al*. (2004)[4], evaluating the surface roughness of the polished resin with a system of wheels and different granulations with silicone tip. Exactly 12 specimens were made. The first group were polished with Sof-Lex discs (dark blue backs, medium blue and light blue, respectively) of 19,5 mm diameter and the second group, with Enhance tips, running up horizontal movements and plans of back-and-comes with the dental pen at low speed, intermittently, for 30 seconds. It was concluded that: the average roughness Charisma resin, polished with silicone tip Enhance is approximately 251 % higher than the average roughness of the polished resin with Sof-Lex sanding discs. Although the roughness index of the tip Enhance silicone has proven high, the results are clinically acceptable.

Marson *et al.* (2005)[5], clinically evaluated the effect of home bleaching. Exactly 40 patients were selected with pre-established criteria, such as having healthy teeth. Patients underwent randomly to the following groups: G1 carbamide peroxide 10 % (2 hours/ day). G2 carbamide peroxide 10 % (8 hours/ day). G3 carbamide peroxide 16 % (8 hours/ day). All were used for 15 consecutive days, wherein sensitivity was checked and cataloged. The gingival irritation level also. Was assessed study 36 % had any side effects, 25 % for sensitivity and 12.5 % of gingival irritation. All groups showed sensitivity, and those who had more were those who stayed longer exposed to the whitening gel.

Pozzobom *et al*. (2005)[6], analyzed the roughness of the in vitro due to restorative materials, bleaching agents and time. We used the glass ionomer cement (GIC) and 3 different types of composite resin. Exactly 120 specimens were made with 2 bleaching agents to be used: 10% carbamide peroxide and hydrogen peroxide 35%. The samples were analyzed for roughness and different groups with different periods of observation of the bleaching agent acting. As a result, there was a significant difference for the factors "materials" and "time." The study showed that the restorative materials generally undergo change when exposed to different bleaching and over time. Surface roughness showed different levels for the material factor.

Soares *et al*. (2008)[7] proposed show the effects of bleaching on oral tissues, restorative materials and care should be taken to the vital teeth. Studies have shown that with the home bleaching with carbamide peroxide, significantly reduced the bond strength of composite resins with the etched enamel. It is advisable to make the resin restoration 7-14 days after the end of bleaching. It was found that the practice of bleaching alter the surface roughness of the VSD and the composite resin.

Marson *et al.* (2008)[8] have investigated the influence of tooth whitening at different concentrations on the bond strength to enamel, and found the influence of time between bleaching and the restoration of the bond strength. Fifty freshly extracted human molars, free of fractures or irregularities, stored in saline were used. The roots of the teeth were removed and sectioned in the coronal part of its long axis. Were randomly divided into five groups. The G1 was the control group, was stored in artificial saliva changed daily. In G2 and G3 groups, the gel carbamide peroxide at 10% for 14 days for 2 hours/ day for bleaching the enamel substrate. The G4 and G5 groups were submitted to seven whitening sessions with 35 % hydrogen peroxide. It was estimated that G2, G3 and G5 showed adhesive strength results similar to the control group (not cleared). The G4 bleached with hydrogen peroxide at 35 % and restored 24 hours later, had its bond strength between enamel and composite resin reduced.

Becker *et al*. (2009)[9], evaluated the effects of bleaching typically used in office on the composite nanoparticle. Were made 28 specimens, which microhardness tests were done before and after whitening, and did not differ significantly between the groups. Also showed no difference when used homemade technique (hydrogen peroxide and 7.5 % carbamide 10 %) and office equipment (hydrogen peroxide and 35 % carbamide 35 %). The Tukey's test showed reduced hardness as compared to untreated body. Bleaching agents did not alter the hardness of the composite nanoparticle compared to the control group.

Azevedo *et al*. (2011)[10] evaluated the microhardness of composite resins, and nanohybrid microhybrids in vitro before and after office tooth whitening. Used Opallis resin and Bright new line, and bleaching products of 35% hydrogen peroxide (HP) of Whiteness HP Max and 37% carbamide peroxide (CP) of Whiteness Super. Were made with 10 groups specimens, all with 3 applications each. G1 to G5 with Opallis resin and G6 to G10 resin Brilliant Newline. Without bleaching G1, G2 and G7 with a pH of 35% and a session, G3 and G8, with 35% and PH 2 sessions, G4 and G9 PC 1 and 37% session, G5 and G10 with 37% PC and 2 sessions, without bleaching G6, G7 with PH of 35% and a session. All specimens were filled with resin according to the group, and respecting the rules of the manufacturers of each whitening gel. In the study was obtained as a result there was no change in hardness values of composite resins in both, regardless of the number of bleaching and applied sessions. Bleaching used did not change the hardness of composite resins.

Daniel *et al.* (2011)[11] investigated possible changes in enamel and roughness of composite resins with different bleaching techniques. Exactly 18 central bovine incisors were used, which were standardized and cavities restored with composite resin. The specimens were randomly divided into: G1 with carbamide peroxide (CP) to

10% for 8 hours daily for 21 days. The groups G2 and G3 with hydrogen peroxide (HP) to 38%, both the brand Opalescence brand and handled in accordance with the manufacturer. G2 by 45mim, 3 15mim each application, 1 week apart, and during the interval were stored in artificial saliva neutral pH. The group G3 was performed in the same manner as G2, only it was subjected to irradiation with LED device. Exactly 3 readings were made roughness of the enamel composite resin and the 6 specimens of each group and microscopic examination done to evaluate the surface morphology. With the absence of bleaching, did not change. Considering the sides bleached and non-bleached of the enamel evaluated, 10 % PC was significant change surface roughness, while the pH to 38% did not change. There were no morphological changes in glazes and not in resins. Observing the groups was analyzed that the type of bleaching influenced only in the roughness of the enamel. The PC application led to changes in morphology and roughness of enamel, and the pH did not alter anything. No restorative procedure changed significantly composite resin.

Pupo *et al.* (2011)[12] evaluated the effect of different bleaching agents on the roughness of resin. Composites were used nanohybrid Bright New Line (BNL) and microhybrid Opallis (FGM). The bleaching agents were chosen hydrogen peroxide (HP) 7.5 % (SS White) and peroxide carbamide (PC) 16 % (Whiteness Perfect FGM). The resins were placed in metal molds and divided into 6 groups. G1 Opallis without bleaching agent. G2 Opallis % at pH 7.5. G3 Opallis with 16% PC, G4 B.N.L. control. G5 BNL PH 7.5%. G6 B.N.L. with 16% PC. After 24 hours stored, the samples were bleached according to the manufacturer's standards. The results revealed that the Opallis resin did not show significant results when the roughness. Already B.N.L. resin change significantly after bleaching. With the study concluded that bleaching agents have the ability to alter the roughness of the resin and the particle size interfere in this regard. The smaller the particle, the greater the chance.

Wang *et al.* (2011)[13] 13 investigated the action of different bleaching agents in the roughness of different composites. Samples of composites of marks were used: Fil-tek Supreme, Filtek Z350, Grandio, Opallis, Filtek Z250. The bleaching agents used were: Whiteness HP Whiteness HP maxx, standard Whiteness. Were used enamel block stored in 0.1 % thymol solution for 30 days. In the groups using HP and HP Maxx as bleaching, each sample was cleared by week 10 i, with the activation was carried out 30 seconds after 5 minutes of whitening. The bodies were for 1 week in deionized water to a repeat bleaching, which was done in a total of 4 weeks. Be done before bleaching and after each week was performed using a surface roughness test. The surface shape was evaluated in triplicate and were used two ways: ANOVA and Bonferroni. The ANOVA showed a significant difference and did not alter the roughness when used Filtek, Opallis, and enamel, compared with the control group. HP Maxx Whiteness was not affected. Grandio had significant change with time. Opallis, Filtek Z250 and Supreme had little change with time. The supreme had to change as significant roughness between 1 ° and 2 ° week. Grandio and Filtek Z350 did not. Z250, enamel and Opallis showed change over time. In conclusion, to the study the changes of the roughness of the composite, after whitening, depends on the material and time, and the enamel was less affected surface.

Pereira *et al.* (2012)[14] evaluated the hardness and surface roughness of a microhybrid composite resin-based silorane, subject to immediate bleaching with hydrogen peroxide containing 35% calcium. A resin was used microhybrid composite, and the bleaching agent used was hydrogen peroxide containing 35% calcium. The specimens were divided into 3 groups: Group 1 composite without bleaching. Group 2 composite subjected to two bleaching sessions immediately with hydrogen peroxide to 35% with calcium. Group 3- composite subjected to two rounds of immediate bleaching with 35% hydrogen peroxide with calcium stored for 7 days in artificial saliva at 37 ° C. As the bleaching agent was applied a layer about 2 mm in thickness on each specimen for 40 minutes. An analysis did not identify significant differences between the groups in terms of roughness ($p = 0.481$), although the control average was higher than the other groups. On the other hand, another analysis of variance showed significant differences between groups in terms of microhardness.

Sossai *et al.* (2012)[15] conducted a systematic literature review on the internal tooth whitening, emphasizing techniques used today, bleaching agents, indications, contraindications, clinical implications, mechanism of action and its effectiveness or rapid and safe promote tooth whitening and more aspects. In review of the literature shows that when the bleaching is carried out using the technique practice, according to the same authors studies have revealed that severe morphological alterations in the enamel surface refers specifically to an increased porosity and roughness that structure, which may be responsible for the decrease in microhardness. Based on the literature, it appears that the isolated or associated use of tooth whitening techniques are subject to risks and side effects.

Zuryati *et al.* (2013)[16] assessed the effects of home bleaching of different types of composite resin. Resins used universal nanoparticulate, resin nanocomposite previous generation and nanohybrid resin. Eighteen samples of each resin were prepared, totaling 54 specimens, subjected to curing for 20 seconds and polishing. The samples were divided into 3 groups containing 6 specimens: G1 represents the control group. G2 was

bleached with Opalescence 10 %. The G3 Opalescence was 20 %. All whitened groups were exposed to bleaching agent according to the standards of the manufacturers. All samples were subjected to surface roughness test using atomic force microscopy after this test, all the samples were subjected to hardness testing using a Vickers. As for the results obtained show that after 14 days exposed to bleaching agent, was not significant compared to the control group. Terms of hardness, there was significant change. The Kelfil resin, whitening after 14 days, an increase of hardness using carbamide peroxide 10 %, and 20 % carbamide peroxide bleaching was decreased, and hardness. The TPH3 resin after bleaching was reduced hardness, both with 10 % and 20 % compared with the control group. It concludes with the research that bleaching agents do not alter the roughness, but the toughness can be altered depending on the material used.

Fanirelle *et al.* (2013)[17] evaluated the direct contact of the whitening gel in composite restorations changes the physical properties of the restorative material. In the literature review shows that the bleaching agent hydrogen peroxide base can affect the surface roughness of composite resin restorations. This increased surface roughness likely occurs, as in the case of changes in the surface hardness of the composite, due to the action of hydrogen peroxide remains the organic matrix of the restorative material. The roughness of the seems to be more affected than the microhardness of the material. Concluded that bleaching agents can induce changes in surface microhardness, surface roughness and color of composite resin restorations present in teeth submitted to bleaching.

Oliveira *et al.* (2013)[18] evaluating the roughness and weight loss of 3 brands of acrylic denture teeth before and after toothbrushing abrasion test. Used 30 specimens divided into 3 groups (G1 Trilux, Artiplus G2, G3 Premium). Initially submitted the samples to surface roughness analysis in roughness (Surf-test 301- Mitutoyo - Sao Paulo, Brazil) and weighed on an analytical balance. Submitted the samples to brushing two years. Concluded that Artiplus teeth were rougher and teeth Premium lost more weight as a result of brushing.

Souza *et al.* (2014)[19] assessed in this study the color stability of a composite subjected to three concentrations of carbamide peroxide. Exactly 40 specimens divided into 4 groups were made. The resin composite specimens were submitted respectively to the exposure of the gel composed of carbamide peroxide 10%, 16% and 22% Whiteness® (FGM, Joinville, SC) for 14 days for two hours. In the control group was not made any application of gel, only evaluated the color of the resin composite specimens before and after application of the gel in the other groups in order to validate the methodology used. The readings for color evaluation were carried out by means of reflectance spectrophotometric technique. Among the different concentrations of carbamide peroxide, which is present at the concentration of 10% was able to clear all the composite test samples (statistically different). Have what is presented in the concentration of 16% cleared 50% of the composite resin specimens (statistically different). The carbamide peroxide that is presented in the concentration of 22 % cleared 50 % of the resin composite specimens, dark 40 % (statistically significant).

The aim of this study was to evaluate the effect of carbamide peroxide gel in concentrations of 10 and 16 % over a microhybrid composite, as the roughness and mass loss.

2. MATERIAL AND METHODS

This was held at the Dentistry Laboratory of the University Severino Sombra, Vassouras, RJ, Brazil.

Specimens

Were made 30 specimens (spc), divided into 3 groups. The samples were mounted in a silicone matrix and were left with the following measures: 5.62 mm in diameter and 2.80 mm thickness (Figures 1, 2 and 3).

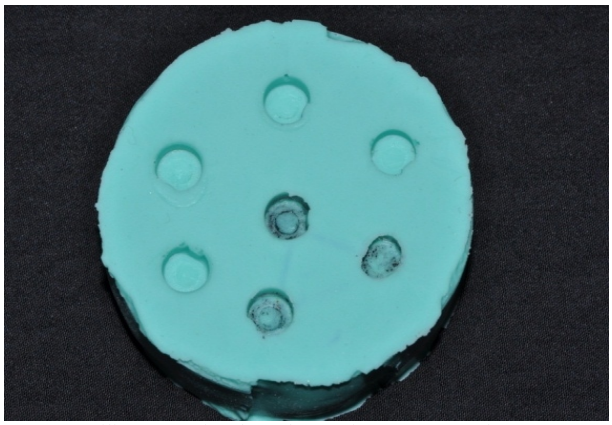

Figure 1. Silicone matrix where the specimens were made.

Figure 2. Diameter of the specimens.

Figure 3. Thickness of the specimens.

For mounting of the specimens was used photopolymerizable resin Opallis® (FGM, Joinville, SC) in A 3,5 color (Figure 4).

Figure 4. Compound used for preparation of specimens.

To polymerize the samples, we used the curing light (LED Coltolux®) for 60 seconds of exposure (Figure 5).

Figura 5. LED used in the polymerization of the composite resin.

We selected two different concentrations of carbamide peroxide contained in Table 1.

Table 1. Distribution of the groups.

G1 Control (10 spc)	----
G1 (10 spc)	CARBAMIDE 10%
G2 (10 spc)	CARBAMIDE 16%

The spc were numbered from 1 to 10 with a ballpoint pen according to the belonging group (Figure 6).

Figure 6. Specimens listed and divided in their respective group.

In order to perform the tests with bleaching gels were used carbamide peroxide 10% and 16% (Whiteness Perfect - FGM, Joinville, Brazil) (Figure 7).

Figure 7. Carbamide peroxide at a concentration of 10% and 16%.

Test implementation of bleaching gels

For the test with bleaching treatments, the samples were placed on a glass plate and applied the bleaching gels on each specimen (2 hours per day, repeating for 14 days), according to the belonging group (Figure 9).

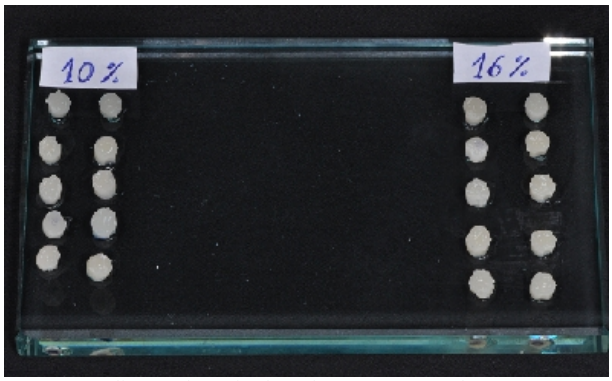

Figura 8. Aplicação dos géis clareadores nos corpos de prova.

The specimens were weighed on a precision scale before and after testing with bleaching gels, accurate to 0.1 mg.

Analysis of surface roughness

Initially, thirty specimens (of microhybrid composite) were analyzed in surface roughness according to ABNT - NBR ISSO4287 with Surftest 301 roughness (Mitutoyo - São Paulo, Brazil) which has a diamond tip with a needle tip radius 5 microns scheduled to go perpendicular to the surfaces of spc (Figure 10). The reading was performed at three different points, to analyze the surface roughness before the application of bleaching gels. For each spc was obtained an average of three readings expressed in Ra (average surface roughness) and were subject to the following standardization reading:

- Type of reading: Ra
- Cut-off: 0,8mm
- Speed reading average: 0,5 mm/s
- Reading mode: sequential
- Action radium: 80µm

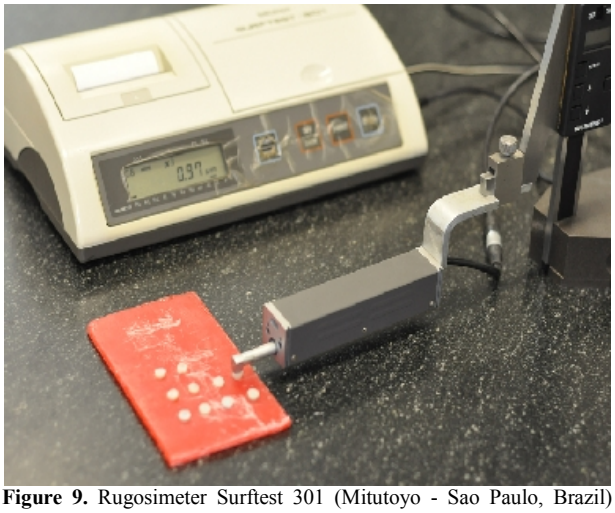

Figure 9. Rugosimeter Surftest 301 (Mitutoyo - Sao Paulo, Brazil) performing the reading of the surface roughness of spc.

The whitening gel was applied once per day for each test specimen and then immediately was removed and subjected to washing and drying.

After 14 days of testing, the samples were weighed in the same analytical balance and then the final roughness was measured.

For analysis of possible changes in the surface roughness of the resin was applied "t" test comparing the means of the control group the mean following the application of carbamide peroxide gel 10 % and 16 %, separately. In the weight variation analysis, paired "t" test comparing the weights before and after application of the gel carbamide peroxide 10 % and 16 % was applied separately. We considered the significance level of 5% ($\alpha = 0.05$) and used Microsoft Excel and GraphPad Software programs.

3. RESULTS

According to the "t" test the differences in roughness between the mean of the control group and 10 % carbamide peroxide were not significant ($p = 0.2093$, $t = 1.342$) and also with the carbamide peroxide 16% ($p = 0.2884$, $t = 1.111$) (Figure 11).

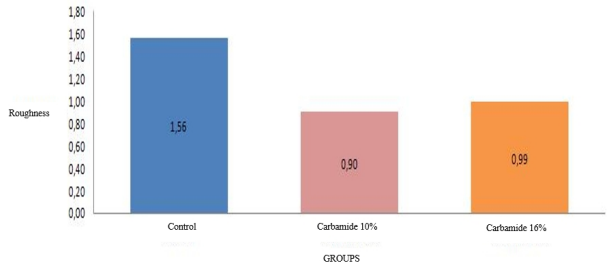

Figure 11. Roughness change.

In terms of weight, the Student "t" test was extremely significant ($p = 0.0002$, $t = 5.893$) between the resin weight before and after application of 10% carbamide peroxide. The same test indicated highly significant differences ($p = 0.0019$, $t = 4.345$) between the resin weight before and after application of 16% carbamide peroxide (Figures 12, 13 and 14).

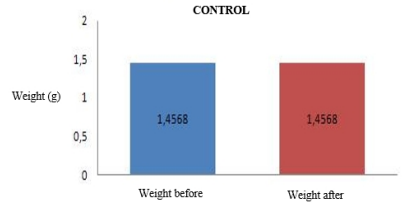

Figure 12. Control - G1

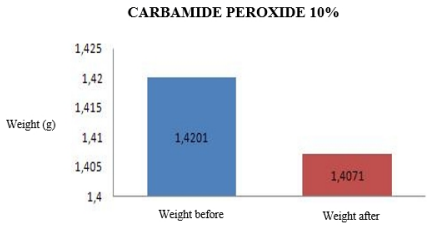

Figure 13. Carbamide peroxide 10% - G2

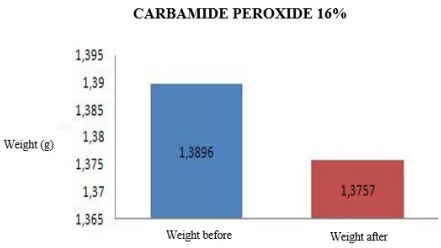

Figure 14. Carbamide peroxide 16% - G3

4. DISCUSSION

The composite resin together with bleaching agents has been constant used in treatment plans implemented in everyday practice. Many studies have been conducted with both materials, but the action of the whitening gel on the composites is not yet fully elucidated so we can have a safe clinical management.

The use of composites by direct technique in anterior teeth is an alternative able to meet the aesthetic requirements of the patient. Much of the existing composite resins on the market are microhybrids and has particles with an average size between 0.04 to 0.7 microns reason why the Opallis resin was chosen for this research[2,3].

Tooth bleaching is largely complete and supervised by the Dental Surgeon. It has advantages such as low cost and is a relatively simple procedure. Dental bleaching enables the professional and patient clinical outcome favorable, increasing the value and the brightness of the enamel. For this work the gel carbamide peroxide at concentrations of 10 and 16% were chosen because they

are easily found in the market[1,3].

Studies show that restorative materials such as composite resin, undergo change when exposed to different bleaching and over time.

In the survey the gel carbamide peroxide in concentrations of 10 % and 16 % were able to change the roughness of composite resin used for the samples. Interestingly the samples were smoother after exposure to bleaching agent. The gel carbamide peroxide 10 % left the resin specimens made smoother than those submitted to gel at a concentration of 16 %[6,7].

The size of the particles in the composite resin, interfere as the clearance of the ability to change its roughness, and that the smaller the particle, the greater the chance. Bleaching agents have the ability to change the surface roughness of the resins. Changes to the roughness of the composite, after whitening, depend on the material and time. The composite resin used was microhybrid and had roughness changes and weight loss after the action of the bleaching agent[12,13].

Bleaching agents can induce changes in surface microhardness, surface roughness and color of composite resin restorations present in teeth submitted to bleaching[17]. Since Pereira *et al*, (2012)[14], did not identify significant differences between the groups regarding the roughness of a microhybrid composite subjected to immediate whitening. Zuryati *et al.* (2013)[16] found that the bleaching agent does not alter the roughness of different types of composite resin, but the hardness can be changed depending on the material used. Disagreeing with these studies, the present study showed changes as the roughness.

Studies such as Oliveira *et al*. (2013)[18], claimed that the mass loss of restorative materials happen by physical agents such as brushing procedure with toothpaste. The microhybrid composite mass loss suffered by a chemical agent, where the gel carbamide peroxide concentrations of 10 % and 16 %. The gel carbamide peroxide at 10 % resulted in more weight loss than the gel carbamide peroxide at 16 %.

Souza *et al*. (2014)[19] in their study showed that the composite subjected to the bleaching gel carbamide peroxide at different concentrations, was able to modify the color composite. Thus, it is seen that the carbamide peroxide gel modifies various properties of the composite health professionals should careful an evaluation to diagnose the replacement of restoration.

More studies should be performed in order to elucidate the reason why the 10% carbamide peroxide gel was able to promote more alterations in microhybrid composite than 16% gel.

5. CONCLUSION

After statistical analysis, we conclude that the carbamide peroxide gel in 10 % and 16 % concentrations is not able to significantly alter the roughness of the composite. However, there was mass loss of resin specimens made in two concentrations, the greatest mass loss change occurred with the gel 10%.

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