Effect of bleaching materials and whitening mouth wash on surface roughness of two types of composite resin materials nanohybrid and nanofill: an In-vitro Study

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Background and objective: Bleaching teeth is one of the effective, comparatively safe, aesthetic treatments in dentistry. Many systems are available now in clinical practice that has a peroxide mechanism. The purpose of this study was to evaluate the effect of three different bleaching system on the surface roughness of two different composite resin materials (nanohybride and nanofilled).

Methods: A total of 60 samples of two types of composite resin were used (nanohybrid and nanofill), 30 samples for each material were prepared. The total samples then divided into six groups, ten samples for each group. Each group were analyzed and tested before exposing to bleaching system that considered as control, by using surface roughness (Ra) machine using atomic force microscopy. Three bleaching system then used, hydrogen peroxide 35% with laser and carbamide peroxide 10% three times each time for 15 minutes while whitening mouth wash for 1 minute/ day for one month. After bleaching ended, the surface roughness of all the samples were re-evaluated.

Results:Whiting mouth wash thtcontaing peroxide bleaching agents showed a significant differences for the two composite materials(nano hybrid and nano filled). While for the another bleaching systems(hydrogen peroxide and carbamide peroxide) there is no significant differences

Conclusion:Whiting mouth wash showed more surface roughness for the two materials when compared with the another bleaching materials and Increased surface roughness of composites as a result of bleaching appears to be dependent on the bleaching agent used as well as the composite material types.

Key words:Nanohybrid composite, Nanofill composite, Peroxide, Roughness, Whitening mouth wash.

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Introduction

Currently, dental bleaching is one of the most commonly used dental esthetic clinical procedures. This treatment offers higher self-esteem to patients with minor consequences to teeth and gingival tissues when it is well indicated and performed. [1]

The American Dental Association discovered guidelines for the acceptance of bleaching products. [2] Peroxide-bleaching material is classified into three categories professional in -office agents, professionally supervised agents for use by patients at home, and over-the counter (OTC) bleaching products [3] like, whitening strips, whitening pen, whitening mouth rins and home bleaching.

Although peroxide has different forms, such as hydrogen peroxide, carbamide peroxide and sodium per carbonate, and the methods of application differs with such options as gels in

trays, strips, films, or paint-on gels, all of them have been shown to be sufficient.[2,3]
In-office bleaching, which is performed by a dentist in the dental office, is the treatment of choice if rapid result is desired. [4] High concentration of bleaching agent gel reaching (35- 38%) of hydrogen peroxide is applied at the tooth surface and allowed to remain on the teethsurfaces for 30-45 minutes. A chemically activated bleaching material, or usually a visible light curing lamp, is used to enhance the bleaching process.[5]
Home bleaching, which is night guard vital bleaching, it was first described by Haywood and Heymann (1989).It is the most commonly recommended treatment modality for vital teeth. [2]
Among the newest whitening products available are whitening rinses. Like most mouthwashes, they freshen breath and help reduce dental plaque, caries and gum disease. But these products also include ingredients, such as hydrogen peroxide in some, which whiten teeth. Manufacturers say it may take 12 weeks to see results. [5]
However, bleached teeth might have tooth-colored restorations. The clinical longevity of tooth-colored restorations might be affected by chemical processes of bleaching agents. [2]
The effects of bleaching agents include changes in surface morphology and in the physical and chemical properties of tooth-colored restorative materials In addition, it has been shown that the surface roughness of composite resins is affected to a great extent by bleaching procedures. [3]
The restorative composites are composed from various polymeric matrix, filler particles, and coupling agents [4], these components directly influence on the properties of composites. [4,5] The resin matrix consists of a blend of organic dimethacrylates monomers with different size and amount of filler particles. Filler particles play an important role on the mechanical properties of composites, such as flexural strength, fracture toughness, microhardness, and surface roughness. [1,6] So that the composites may undergo degradation inside the oral environment, resulting in changes of the mechanical properties. [5]
Therefore, the aim of this in-vitro study was to evaluate the effect of different bleaching material on the surface roughness of different types of composite resin restoration.

Materials and Methods

Sixty samples from two types of composite materials(nanohybrid and nanofilled) were prepared (30 samples for each materials), these samples then divided to form six groups, ten samples for each group for the same material and three bleaching system were used to bleach these samples, thenSurface roughness measurements were carried out on all experimental groups before exposure of the specimens to the bleaching agents protocol and considered as a controls, after that the surface roughness measured by surface roughness machin after exposing the samples to bleaching system then the data were collected . (Table 1)

Samples preparations. In this experiment, 60 round samples were prepared by using metal mold 10 mm in diameter and 2 mm in thickness (30 samples for each materials), the color corresponding shade A2 was used for the two materials.[7] (Figure 1)

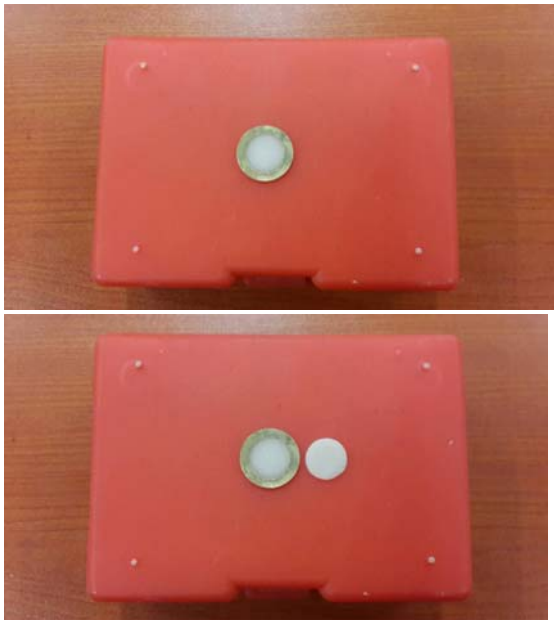

Figure 1: Samples preparation.

During samples preparation, materials were handled according to the manufactures instructions.The molds were placed on transparent plastic matrix strip lying on glass.The resin specimens were covered with transparent polyester film strips (3mm flip frame, 3M visual systems Divesion, Austin Tx ,USA) to get smooth and flat surface, then a glass plate was placed on the top of molds and gentle pressure applied to extracts excess of

Figure 2: Samples preparation, The molds were placed on transparent plastic matrix strip lying on glass

The surfaces of specimens was polymerized using a blue light emitting diode (LED) unit (opticalfiber G-w 0.7kg N-W 0.45 kg Dimension 256 mm X 204mm X 96mm)(WOOD PECKER CO. national high –Tech Zone. Guilin ,Guangxi P.P China 5411004), for 40 seconds from both top and bottom of surfaces of the samplefollowing the manufacturer instructions.[7] All samples were then polished using one step OptraPol (Ivoclar-Vivadent AG). The disc shape of OptraPol was used with moderate pressure for 15 sec for each sample. The samples were then stored in 100% humidity at 37°Cfor 24 hours before initiation of any procedure for surface roughness with (optical surface profilometer) as a base line surface roughness as control groups.[8]

Bleaching procedure and grouping systems. The treated specimens were washed first under flowing distilled water with a soft tooth brushes and then in ultrasonic cleans for 5 minutes. Then they were placed in fresh distilled water until the next application, the distilled water was replaced every day.[9]

The specimens of each composite material were divided as follow:

Group 1: The samples (n=10) of nanohybrid composite were bleached by hydrogen peroxide 35% using laser three times each time for 15 minutes.

Group 2: The samples (n=10) of nanohybrid composite were bleached chemically by carbamide peroxide 10% three times each time for 15 minutes.

Group 3: The samples (n=10) of nanohybrid composite were placed in whitening mouth wash for 1 minute/day for one month.

Group 4: The samples (n=10) of nanofill composite were bleached with hydrogen peroxide 35% using laser 3 times each time for 15 minute.

Group 5: The samples (n=10) of nanofill composite were bleached chemically by carbamide peroxide 10% three times each time for 15 minutes.

Group 6: The samples (n=10) of nanofill composite were placed in whitening mouth wash for 1 minute/ day for one month.

For **group 1and 4**, samples disk immersed with hydrogen peroxide 35%,then exposed to laser light for 3 sessions each session for 15 minutes. Samples then washed and dried andthe surface roughness were measured and data collected.

In **group 2 and 5,** samples immersed in 10% carbamide peroxide,three times each time for 15 minutes. at room temperature in light proof container as a manufacture recommendation.

In **group 3 and 6**, samples of both types of composite resin subjected to bleaching mouth rinse in glass container for one month each day for 1 minutes/ day.

After the bleaching time all the samples were washed out under running tab water to remove any bleaching agents residue and then stored back in distilled water until used, and then surface roughness were detected for each sample and data were collected.

Between bleaching regime (or episode) each sample were polished by using one step Optra (disk ½ coars /5 aluminium

oxide and polishing paste with fresh minite then samples were washed with water and tooth brush and dried with air water triple syringe.[8]

Surface roughness measurement. Surface roughness for all samples were measured befor any bleaching regime and we considered as control .then after bleaching the samples, the surface roughness test (Ra) was performed using atomic force microscopy in the exact center of the specimen at (25 × 25) mm surface area was inspected-

Figure (3): surface roughness (Ra) machine, atomic force microscopy.

Statistical analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS, version 18). One way ANOVA test was used to compare the mean rank of the smear layer removal of the study groups. A p value of < 0.05 was considered statistically significant. Mean values and standard deviation of surface roughness (in µmm) for nanohybride and nanofilled composite resin after bleaching methods are shown in **Table 2 and 3** .

In nanohybrid composite specimens there was no statistically significant difference in surface roughness after bleaching with laser + hydrogen peroxide (P>0.05) also no statistically significant difference was found in surface roughness of groups bleached with 10% carbamideperoxide (P > 0.05) but in groups of specimens were bleached with whitening mouth there was statistically significant difference in surface roughness after bleaching and polishing (P value <0.05) as shown in **Table 2.**

Also in this study it was founded that there was statically significant difference in surface roughness parameter of nanofilled composite specimens after bleaching of specimens with whitening mouth rinse and surface polishing (p value was <0.05) but specimens that bleached with laser + hydrogen peroxide and 10% carbamide peroxide showed no statistically significant difference in surface roughness which was found P >0.05 as shown in **Table 3.**

Discussion

In the present study, the surface roughness of two types of resin composite restorative materials was investigated after different bleaching method. It was found that whitening mouth wash affect more on the surface roughness of the two types of composite materialswhen compared with theother bleaching methods which is due to chemical composition of whitening mouth wash as Villalta et al [10] have shown that low pH and alcohol concentration of

Table -1- Materials and equipments used in this study.

Materials	Manufactures	Compositions
Nonhybride composite resin	IvoclarViradent, Schaan, Lichchtentein	Matrix Dimetha acrylates, additives, catalyst.Stabilizer pigments. Filler (82.5%wt) Barium glass Yetterbium-trifluoride, mixed oxide prepolymers, 68% content by volume.
Nanofilled composite resin	3M dental product,st.paul MN,USA. Cuilin woodpecker Medical instrument co., Ltd	Matrix.Bis,GMA,UDMA/Bis EMA6,and small quantities of TEGDMA Filler(78%wt)silicazirconia cluster Filler:(0.6-10μ)zirconia particles(U-mm)
Curing light	Information industrial park. National High- tech 2on,Cuilin,Cnangxi.R.R.china541004 (wellkangL+d(www.CE-markinge.n) 29 Harleyst. , London W1G9QR.VK	LED light
Bleaching laser	Beyond II whitening Accelerator Model:By-0898M.(powerful 150) Watt halogen bulbhigh intensive blue	Laser 12 blue LED light using halogen source fine granulated
Polishing paste	Spectra .PrevestDenpro	paste with fresh mint
Polishing bur	Star dent trading company Foshan,Guangdong,china 141220	1⁄2 p0p.0n disk 85⁄Bx,coars aluminum oxide 2382C
Opalescence PF	Ultra dent product , south Jordan ,UI,USA	10 Y. Carbamide peroxide
Colgate plox Alcohol free	Plax. BR122A	Water,glycerin,propylene gly-col,sorbitol ,PGE-40 hydrogenated
Whiting mouth wash	KIK Custom Product ,Etocicoke , Canada	Caster oil aramo, phosphoric acid Sodiumbenzoate,cetylpiridinium chlo-ride, sodium fluoride Sodium saccharin CI42090
Office Laser bleaching	Beyond Technology Group Nanchange.Jaiagxi china	Y35 hydrogen peroxide

Table 2: Mean value and standard deviation of initial roughness (IR), roughness after bleaching (RB) and final roughness (FR) for all experimental (nanohybrid composite).

Groups	IR Mean &SD	RB Mean &SD	FR Mean &SD	P value
G1	17.09 (4.61)	23.48 (6.12)	20.9 (5.1)	0.26
G2 10% carbamide peroxide	21.6 (4.93)	28.08 (14.4)	21. (4.93)	0.07
G3	13.74 (5.11)	20.5 (3.1)	16.8 (1.1)	0.018

Table 3 :Mean value and standard deviation of initial roughness (IR), roughness after bleaching (RB) and final roughness (FR) for all experimental nano filled composite resin.

Groups	Initial roughness Mean &SD	Roughness after bleaching Mean &SD	Final roughness Mean &SD	P value
G4 Laser +hydrogen peroxide	**13.91(4.61)**	**22.4 (6.63)**	**21.34 (5)**	**0.3**
G5 10% Carbamide peroxide	**13.8 (4.5)**	**29.77 (9.23)**	**21.4 (5.01)**	**0.4**
G6 Whitening mouth wash	**16.81 (1.17)**	**20.58(3.11)**	**13.74 (5.11)**	**0.00**

solutions might affect the surface roughness of composite resins and Also the results were matchewith Alaa J (2016) who found that the mouth rinse affect on the surface roughness more than other groups that treated with another bleaching materials.[11]

On the other hand Asmussen [12] showed that mouth rinses with high alcohol content might soften the composite resin material.so ethanol especially has a softening effect on BIS-GMA–based polymers.Also Gürgan et al [13] reported that irrespective of alcohol concentration, both alcohol-containing and alcohol-free mouth rinses could affect the roughness of resin-restorative materials.

Yap&Wattanapayungkul (2002) [14], when evaluated the effect of carbamide peroxide at 35%in the roughness of composite resin, they found that there was not changes in the roughness. [1,14]

The size of the fillers of composite resin is one of the factors that determines the SR and polishability of composite material. A large size of the particles in composite matereial might increase micro porosities in its structure. Polishing of composite resins is determined based on the longest diameter of fillers. [15] Composite reins with larger particles tend to exhibit more surface roughness when they are exposed to abra-

sive agents.[16]

There is controversy in the previous studies over the effect of bleaching on SR of dental materials. Some studies have foundedno changes in SR of the restorative materials after bleaching. [17-21] Some others have observed decreases [22,23] and some increases [24-26] according to this parameter.

In general, factors that resultin an increases in SR are due to effect of free radicals on filler matrix interface and debonding of filler (loss of adhesion between the organic and inorganic matrix) lead to the formation of microscopic cracks on the surface that can result in increasing the roughness of the restoration. [26-28] Effect of different bleaching materials depends on the oxidation process which occurs in the organic matrix, facilitating sorption of water and resulting in the loss of particles, in a decrease in surface integrity, and in an increase in microhardness.[(27)]So hydrogen peroxide attacks the matrix and results in the softening of materials, leading to the loss of glass. In addition, light, too, can increase the effect of hydrogen peroxide on increasing SR [19]

Munteanu, too, reported the increase in SR to oxidation and destruction of the resin matrix, which result in further loss of the matrix in compares with the inorganic phase. Some other researchers reported that the matrix of composite resins is more resistant to mechanical and chemical challenges and attribute the surface roughness to hydrolytic changes in water, predominantly at the filler matrix interface. [(27,28)]Low concentrations of hydrogen peroxide have no significant effect on the surface roughness of composite reins; however, even concentrations higher than those recommended by the manufacturer have no deleterious effects on composite resin surfaces. [28] El-Murr et al, [25] showed that SR of composite resins increases significantly after bleaching

Also Mortazavi et al, [17] found that SR of microhybrid composite resins was not change after bleaching, which was attributed to the size of fillers in these composite resins that prevent changes in SR even when resin is lost, this study is not mach with our present study.

Although one study [29] revealed an adverse effect of the bleaching procedure on the surface roughness of bulk-fill resin composites.and another study [30] also showed a reduction in the surface roughness of a nano-filled resin composite when bleached with an in-office carbamide peroxide-based preparation for 30 min/W for 3 weeks.

In some SEM studies and profilometric analyses, it was found that 10–16% carbamide peroxide bleaching gels may result in a slight, but statistically significant, increase in surface roughness and numbers of porosities of microfilled and hybrid composite resins. [31,32]

Conclusion

According to the results of this study it was possible to conclude that, the mouth rinses affect the composite surface roughness during the study period (one month).

Alcohol containing mouth rinses can increase the roughness of the resin composite, thus clinician should consider this when prescribing these substances to their patients.

Increased surface roughness of composites as a result of bleaching appears to be dependent on the bleaching agent used as well as the composite material types.

Conflict of interest

The authors reported no conflict of interests.

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