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COMPARING THE EFFECT OF HOME BLEACHING AGENTS ON THE MARGINAL INTEGRITY AND BOND STABILITY BY TWO DIFFERENT BONDING SYSTEMS TO DIFFERENT COMPOSITE RESTORATIVE MATERIALS: AN IN VITRO STUDY

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ABSTRACT

Vital bleaching is now widely demanded by the public and ranks among the most frequent cosmetic treatments in dentistry. Effect of bleaching by carbamide peroxide on bond strength of microhybrid and nano hybrid restorative materials by two total and self-etch bonding systems to dentin has not been investigated intensively. This study aimed to examine the effect of home bleaching using 20% carbamide peroxide on the shear bond strengths of different adhesives systems to two different composite materials to enamel and dentin. Two hundred enamel and dentin disks were prepared from extracted third molars with the dimensions of 5x5x5mm. Samples are then randomly divided into eight groups with 25 samples in each for bonding purposes. Bonding procedures were completed with total and self-etch for each half of nano hybrid and micro hybrid composites. Half of the samples are then subjected to bleaching by 20% carbamide peroxide and other half left as control. Intra group comparison between the results of all four groups showed that total etch and self-etch bond strength on enamel and dentin decreases significantly in post bleach groups compared with control non bleached groups ($P<0.05$).Inter group comparisons between groups show that bond strengths are comparatively higher for etch and rinse groups than self-etch but the differences are statistically insignificant. Within the limits of current study, bleaching significantly reduced the adhesive bond of attached restorations to dental hard tissue.

Keywords: composite restorations, bleaching, carbamide peroxide, bond strength

Introduction:

With the increasing aesthetic concerns demand for the bleaching procedures has increased dramatically in recent past. Vital and non vital bleaching procedures are growing areas of aesthetic dentistry. Currently, there are two main whitening techniques: in-office (professional) and at-home bleaching. When performed correctly, both techniques are efficient and safe.[1]For brightening discoloured teeth, the use of hydrogen peroxide or peroxide releasing agents, such as carbamide peroxide or sodium perborate, has become a popular treatment modality.[2] Vital bleaching is now widely demanded by the public and ranks among the most frequent cosmetic treatments in dentistry. As a result of the increasing demand for aesthetic procedures, many tooth-colored restorative materials have been introduced. One of these tooth-colored restorative materials is composite material. With the advances in material sciences several different composites and their modifications have been introduced with increasing aesthetic properities.[3]There may be these tooth-colored restorations on the teeth to be bleached. The influence of various bleaching agents on physical properties, surface morphology and colour of different restorative materials, has

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been investigated in several in vitro-studies simulating the clinical situation as closely as possible.[4-6] Some researchers have investigated the effects of preoperative bleaching on micro leakage and sealing ability of tooth coloured restorative materials.[7,8] There are very limited studies on the effect of home bleaching materials on the bond strength and marginal integrity of pre-existing resin composite restorations. The aim of our study was to evaluate the effect of home bleaching by 20% carbamide peroxide on the marginal integrity and bond strength of etch and rinse Prime and Bond NT (Dentsply) and self etch adhesive Single Bond Universal (3M ESPE) to nano hybrid Filtek Z 250 XT(3M ESPE)and micro hybrid Te Econom Plus(Ivoclar Vivadent) tooth-colored composite restorative materials.

Materials and methodology

Two tooth-colored composite restorative materials and two bonding agents were selected for this study. The restorative materials included nano hybrid composite resin Filtek Z 250 XT(3M ESPE)and micro hybrid composite Te Econom Plus (Ivoclar Vivadent). The bleaching agents were 35% carbamide peroxide (Opalescence Quick, Ultradent). This study investigated the effect of carbamide peroxide bleaching gel on the durability of the adhesive bond between two types of composite material and enamel–dentin created with the etch-and-rinse adhesive Prime and Bond NT (Dentsply) and with the self-etch adhesives Single Bond Universal (3M ESPE). Bleaching was performed with a 20% carbamide peroxide bleaching gel (Opalescence, Ultradent Products Inc, South Jordan, UT, USA), which is routinely used for home bleaching. Two hundred enamel and dentin disks were prepared from extracted third molars with the dimensions of 5x5x5mm.Dentinal disks were stored in chloramine T solution. Samples are then randomly divided into eight groups with 25 samples in each for bonding purposes. The adhesive systems and the composite material were applied strictly according to the manufacturer's instructions and light-cured with a LED light curing unit.

1. Group 1A --- etch and rinse Prime and Bond NT is applied to enamel-dentin disks then nano hybrid Filtek Z 250 XT compoite is bonded evenly.

2. Group 1B --- etch and rinse Prime and Bond NT is applied to enamel-dentin disks then nano hybrid Filtek Z 250 XT compoite is bonded evenly.

3. Group 2A-- etch and rinse Prime and Bond NT is applied to enamel-dentin disks then micro hybrid Te Econom Plus compoite is bonded evenly.

4. Group 2B--- etch and rinse Prime and Bond NT is applied to enamel-dentin disks then micro hybrid Te Econom Plus compoite is bonded evenly.

5. Group 3A--- self etch adhesive Single Bond Universal is applied to enamel-dentin disks then nano hybrid Filtek Z 250 XT compoite is bonded evenly.

6. Group 3B--- self etch adhesive Single Bond Universal is applied to enamel-dentin disks then nano hybrid Filtek Z 250 XT compoite is bonded evenly.

7. Group 4A--- self etch adhesive Single Bond Universal is applied to enamel-dentin disks then micro hybrid Te Econom Plus compoite is bonded evenly.

8. Group 4B--- self etch adhesive Single Bond Universal is applied to enamel-dentin disks then micro hybrid Te Econom Plus compoite is bonded evenly.

Specimens were left to dry then stored in artificial saliva at 37°C for 1 week. The specimens in the 4 subgroups A i.e. Group 1A, Group 2A, Group 3A,Group 4A were placed in bleaching gel each day for 8 hours; the specimens were subsequently washed under running water to remove the bleaching gel completely, followed by storage in artificial saliva at 37° for 14 consecutive days to simulate the home bleaching technique. After the 14-day bleaching treatment, the specimens were subjected to shear bond testing using a universal testing machine (Instron) and a load cell of 10 kN at a crosshead speed of 0.5

mm/min. The failure modes of the debonded specimens were analysed using a stereomicroscope.

Results

The bond strength values are reported using mean and standard deviation. The descriptive statistics (mean and SD) of the shear bond strength values are presented in Table 1. The shear bond strength data were analysed using SPSS version 11. Comparisons of the mean shear bond strength values between different groups were done by ANOVA. Statistical significance was set at $p \leq 0.05$.

Table 1: Showing bond strength of control and post bleaching groups

Group	N	Mean (MPa)	SD
Group 1A	25	29.8	1.4
Group 1B	25	16.3	1.3
Group 2A	25	27.7	1.13
Group 2B	25	14.2	1.43
Group 3A	25	31.6	1.8
Group 3B	25	21.3	1.2
Group 4A	25	28.9	1.5
Group 4B	25	20.1	1.8

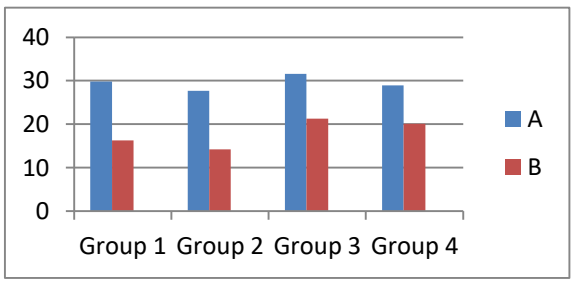

Figure 1: Showing comparative description of control and post bleaching groups

Intra group comparison between the results of all four groups showed that total etch and self-etch bond strength on enamel and dentin decreases significantly in post bleach groups compared with control non bleached groups ($P<0.05$).Inter group comparisons between groups show that bond strengths are comparatively higher for etch and rinse groups than self-etch but the differences are statistically insignificant.

Discussion

Adhesion between the tooth tissues and composite restorations by various bonding agents depends on various factors. The effect of tooth bleaching agents on tooth-colored restorative materials is of clinical interest and several studies have evaluated the effect of commonly used bleaching agents on a number of restorative materials. Bond degradation of various adhesive systems by water depends on quantity and length of exposure.[9,10] However there are very limited studies showing how chemical substances or products intended for use in the oral cavity affect adhesive bond durability. Since the introduction of dental bleaching, the use of bleaching agents for whitening discoloured teeth has become more popular. At-home dental bleaching is a conservative treatment of pigmented or stained teeth.[11] The most frequently used substance in the at home application is carbamide peroxide, which dissociates into hydrogen peroxide and urea. The carbamide peroxide concentration of commercial products varies from 10% to 22%.[11]Thus 20% carbamide peroxide bleaching system was selected for the current study. It is known that especially resin composite and the enamel organic matrix are affected from these bleaching procedures.so, we have taken two contemporary used

composite types i.e. micro hybrid and nano hybrid composite for evaluation of bleaching affects. Even with different composites, the adhesive interface is primarily challenged by the ambient environment. In the present study, we have evaluated the effect of 20% carbamide peroxide adhesive interface created total etch and self-etch adhesive systems used in micro and nano hybrid composites with the bond strength test by universal testing machine. Many studies dealing with the effect of bleaching gels on bond strength provide controversial results.[12,13] Some show that peroxide bleaching gels may induce degradation of adhesive bonds between the composite material and tooth tissues, which is in consistent with the results of our study.[14-17].However majority of these studies used 25–35% hydrogen peroxide. The oxidizing effect of the bleaching agents is may be held responsible for decreasing bond strength. However there are some studies which did not show negative effect of carbamide peroxide on composite-enamel bond strength.[18,19]

Conclusion

In the current study, bleaching significantly reduced the adhesive bond of attached restorations to dental hard tissue. The stability of bonded resin composite restorations to enamel, using different dental adhesives, could be compromised after the bleaching procedure.

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