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Effect of in office dental bleaching on the Microleakage of Class V Restorations

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Abstract
This study was aimed to assess marginal microleakage in cervical cavities restored with different composite resins after in-office bleaching. Methods: A total of forty-two class V composite restorations on the buccal surfaces of extracted teeth were prepared then divided into three groups each group was 14 in number according to the type of composite. After bleaching with 32 percent hydrogen peroxide, a stereomicroscope was used to assess the amount of dye penetration at the gingival and occlusal margins at a magnification of×20 and reported. The non-parametric analysis method (alpha = 0.05) was utilized to evaluate the data. Results: The data demonstrates no significant differences in the microleakage scores obtained between the three groups subjected to bleaching (p< 0.442). Conclusion: Marginal microleakage in composite resin restorations is influenced by the action of bleaching gels applied.

Introduction:

Due to their improved mechanical characteristics, strong bonding to tooth structure, and good aesthetic attributes, composite resins are widely utilized in the modern dentistry. A few of their functional constraints, like stress polymerization shrinkage and resulting micro-leakage, remain a source of great worry. Micro-leakage development in marginal areas will result in secondary caries, enamel cracks, post-operative sensitivity, and restorative discolouration (1). Apart from these restorations, bleaching discolored teeth is a popular and common dental procedure since, in comparison to other approaches, it

represents the most advantageous and conservative technique for the improvement of aesthetic look of teeth (2). For longer-lasting results, vital teeth are usually bleached using professional bleaching techniques first, then at-home techniques. At-home bleaching usually entails utilizing 10–20% carbamide peroxide in specially constructed, prefabricated trays that the patient looks to be wearing at night, office bleaching includes applying 35–38% hydrogen peroxide to the surface of the tooth for 30min–45min (3).

Numerous studies have indicated that there would be more micro-leakage at the margins of the dentin in the Class V resin composite restoration types that were subjected to home bleaching solutions (4-6). Many clinical problems, which include bacterial accumulations, discolouration, and pulp damage, could result from this increase in microleakage (7). Nevertheless, other studies showed that teeth whitening by utilizing a mixture of 35% hydrogen peroxide and10% carbamide peroxide has no effects on the class V tooth-colored restorations micro-leakage (8-10). Even though opinions on how bleaching agents impact tooth-colored restorative materials vary, replacing restoration following tooth bleaching is usually recommended because of the poor post-treatment color matching and compromised restorative material qualities, which might have damaging impacts on the pulp health and the rest of the tooth structure (7).

The potential negative impacts of the peroxides on the restorative materials, particularly on composite resin bonding to the structure of the tooth, which may jeopardize marginal sealing, have been the subject of several investigations (11-13). Marginal microleakage, caused by insufficient sealing and weakening bond strength, allows chemicals, liquids, ions, and bacteria to infiltrate the tooth/restoration interface (14). Because of this, several authors advise utilizing total-etch adhesive techniques to teeth, which will be restored before being bleached (15-17). Hence, the following null hypothesis was put forth for the current work: dental bleaching performed in-office has little impact on slight micro-leakage of resin composite restorations. Examining marginal micro-leakage in the cervical cavities that have been restored with a variety of the composite resins following in-office bleaching was the goal of this investigation.

Materials and Methods

Sample preparation

42 human premolar teeth in total that were free of carious lesions have been selected, cleaned, and incubated in 0.10% thymol solution for a week. Class V cavity preparations (5 x 5 x 2 mm) have been performed on buccal surface with the use of an air-cooled dental surveyor, a high-speed handpiece, and a round diamond bur. The enamel edges of cavities were after that etched for 15sec with 37% of the phosphoric acid, cleaned for 5sec, then dried for 5sec with a light air stream, based on manufacturer's recommendations. As directed by the manufacturer, the G-Premio adhesive agent has been applied to the enamel and dentin walls for 10sec, and then an air syringe was used to vigorously inject air into the adhesive agent. Following the bonding process, one of three varieties of less than 2 mm-thick composite restorations was used to fill the cavities. Before each layer of the repair was polished with polishing disks, it has been light-cured for 20 sec (18). After that, 500 thermocycling cycles between 5 and 55 degrees Celsius were completed by all restored teeth, withhold durations of 30sec and 10sec for every temperature change.

Sample grouping

Forty-two class V composite restorations on buccal surfaces of extracted teeth were used as research samples for microleakage testing. Samples have been divided to three categories according to the composite type:

Group A Tetric N-Ceram resin composite.

Group B OMNICHROMA resin composite.

Group C 3M Z350XT resin composite.

Bleaching procedure

Silicone index was made for the standardization of thickness of bleaching material on the surface of the samples. The bleaching agent (Flash, 32% Hydrogen peroxide) has been applied on the surface of samples with 1mm thickness then activated with dental bleaching light for 15 minutes. Three bleaching cycles were performed in one session according to manufactural instruction. Bleaching procedure was repeated for teeth samples and the same cycles were performed.

Following this stage, inlay wax has been utilized for the apical seal of every sample due to the fact that it shows very little dimensional variations. Following that, samples were put in sealed containers and left in 1% methylene blue for a whole day. The samples were cleaned in an ultrasonic cleaner as well as rinsed under running water before being cut into portions in the center of every one of the restorations in a buccolingual direction with the use of diamond by a cutting machine. The quantity of the penetration of dye at the occlusal margins has been measured by using a stereo-microscope (Model SZF-AL, Kyowa Electronic Instruments Co. Ltd., Japan) at an x20 magnification. The results are as follows: Score0: which represents no dye penetration; Score1: which represents dye penetration up to 1/3 of cavity depth; Score2: which represents dye penetration up to 2/3 of the depth of the cavity; Score3: which represents dye penetration up to the cavity floor; Score4: which represents Involvement of the axial surface (19).

Statistical analysis

The data have been examined with the use of Shapiro-Wilk and Kolmogorov-Smirnov tests to see if they were normally distributed. Due to the non-normal distribution of data (N), the non-parametric analysis method was applied. The data was examined using IBM SPSS 26 Software for Windows. The data were put through Kruskal-Wallis test at a 0.05 significance level in order to see if there would be any difference between the groups.

Results

When the data scores were collected, all groups presented marginal microleakage and the lowest median was for group A Tetric N Ceram and B OMNICHROMA (3) and the highest median was for group C 3M (4). Scores that have been acquired in every group are presented in Table 1 and Figure 2.

Discussion

In routine dental practice, contemporary resin composites were frequently used to restore damaged teeth. Modern resin composites, which may nearly mimic tooth features on the surface as well as those seen in the eye, have significantly improved both in terms of their chemical composition and application techniques (20). On the other hand, a few in-office operations, like bleaching, might negatively affect these traits (21). More often than not, teeth whitening is a temporary solution utilized in order to enhance the aesthetics of teeth. Although there are many other at-home and in-office bleaching treatments that are available today, the most widely utilized gels for in-office bleaching procedures are those based on hydrogen peroxide and carbamide. Although bleaching treatments seem easy for patients, some writers have reported negative effects on oral and dental tissues, and on dental restorations already in place. The bleaching treatment's adverse effects

may be mostly caused by the acidity and potency of the bleach products (22).

In comparison to glass-ionomer and dental amalgam, resin composites represent the most widely utilized direct cosmetic tooth replacement material. Along with their acceptable esthetic and mechanical endurance, such materials offer various clinical uses (20). In order to analyze marginal sealing (23,24) to detect the detrimental effects of polymerization contraction in composite resins, marginal microleakage tests are frequently employed for evaluating adhesion quality in composite resin restorations 27,28. In the case where the aging is evident, then the marginal microleakage tests can assess the bond's long-term quality as long as the relevant standardization and preparation guidelines are adhered to (25). In this work, human teeth were utilized. Every group that underwent bleaching received a score of 3 for microleakage, indicating that the dye entered axial wall. This finding could have one explanation: when bleaching products penetrated into axial wall, they created a space for the pigments to penetrate in too. As a result, oxygen that has been generated during oxidation reaction of the peroxide could cause the dentin/adhesive contact to somewhat deteriorate in addition to chemically breaking down the chromogens, increasing the amount of spaces at the interface (26). There were no appreciable variations in the bleaching agents' effects according to the kind of composite; all groups that underwent bleaching showed minimal microleakage that penetrated the axial walls. This result implies that the hybrid layer of the restoration area can be penetrated by bleaching agents as well as their byproducts, potentially modifying it and lowering the adhesion quality. The thickness regarding the dentin and enamel affects how well hydrogen peroxide bleaching gels penetrate the pulp, as thinner layers of the tooth (such as those in mandibular incisors compared to premolars) facilitate the gels' penetration (27). All the teeth in this work which received bleaching gels had dye penetration into the axial wall, indicating that dentin/adhesive interface is aggressively affected by bleaching gels. In order to avoid future sensitivity, it is crucial to perform a thorough evaluation of the clinical state of prior restorations. Using in-office and at-home bleaching agents didn't differ in the study that has been carried out by Klein *et al*., 2018; that is, marginal sealing was impacted irrespective of the gel type used, and marginal microleakage was caused by the release of oxygen, irrespective of bleaching system type used (28). Microleakage appears to be more closely associated with product concentration and application time as a result. Overall, the results highlight the critical role that dentists play in alerting patients who have had their teeth restored to the potential sensitivity problems that could arise from using bleaching agents, irrespective of the method employed in the restoration process. In this way, tooth whitening appears to depend more on a number of significant variables pertaining to the patient and the dentist after that it does alone on the kind of adhesive system that has been utilized in restorations or the kind of bleaching gel that was utilized previously.

Conclusions

Within the constraints of the current in vitro investigation, the following conclusion could be drawn: the use of bleaching gels affects marginal micro-leakage in the composite resin restorations.

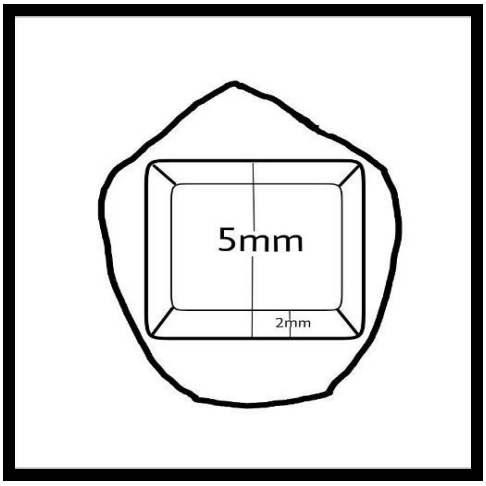

Figure 1: A diagram representing cavity preparation.

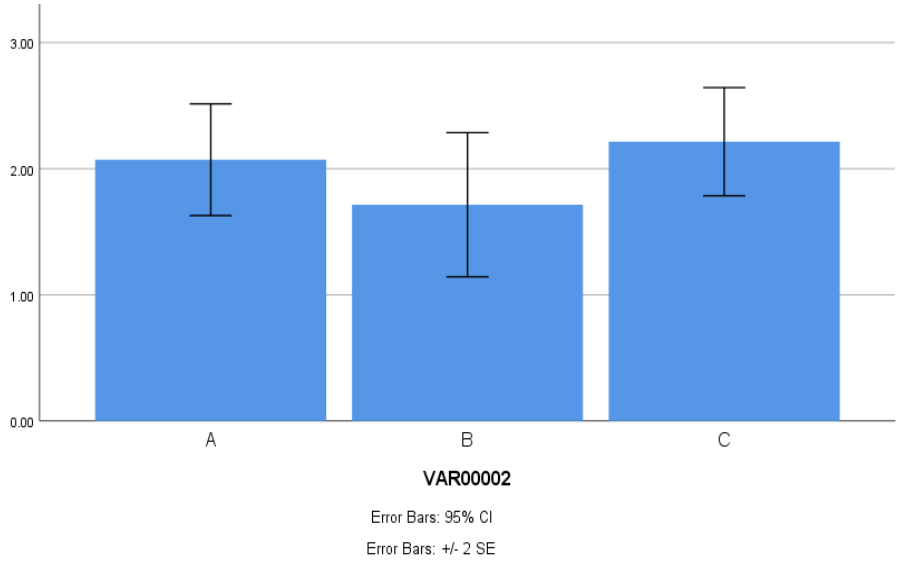

Figure 2: Graphical presentation of the groups.

The microleakage scores obtained by the three groups that underwent bleaching did not significantly differ from one another in the case when the gathered scores were examined with the use of Kruskal-Wallis test ($p<0.442$).

Table 1: Micro-leakage scores that have been acquired in every group and median score.

Micro-leakage score

Groups	N	0	1	2	3	Median
A	14	1	1	5	7	3
B	14	3	1	7	3	3
C	14	0	3	5	6	4

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