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RESEARCH ARTICLE

COMPARATIVE EVALUATION OF 16% CARBAMIDE PEROXIDE ON MICROHARDNESS OF NANOFILLED, NANOHYBRID AND MICROFILLED COMPOSITE: AN IN VITRO STUDY

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ABSTRACT

The aim of the study was to compare the effect of 16% carbamide peroxide on microhardness of nanofilled, nanohybrid and microfilled composite.

Materials and Methods: 20 samples of each composite (Nanofilled, Nanohybrid, Microfilled) were prepared in prefabricated silicon moulds and mounted on acrylic blocks. Microhardness testing was done prior to initiation of bleaching. Then the bleaching process was done with 16% carbamide peroxide. The gel was applied for 4 hours daily for 21 days. Microhardness testing was done post bleaching. The pre and post bleaching values were compared using student t test and one way ANOVA with the level of significance p=0.05. The results showed decrease in microhardness after bleaching for all three composites. The least reduction was seen in case of nanofilled composite.

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INTRODUCTION

Bleaching is an age old treatment whose time has finally come. The technique has been performed for over a century. It is one of the most documented clinical techniques in dentistry and yet for reasons unknown, it has escaped the acceptance that it deserves. The current trend toward cosmetic dentistry has generated more interest in bleaching as patients are asking for whiter and more beautiful teeth. Our society tends to dislike yellowing of teeth that comes with age or the various intrinsic stains that occur developmentally. Different authors, over the years, tried various materials and techniques to aid in bleaching. In early nineteenth century, hydrogen peroxide alone and in combination with other materials, was used as bleaching agent. Products to "whiten" teeth are plentiful in the market place. Bleaching alone can significantly change the appearance of teeth, sometimes in only one office visit and almost less invasively and less expensively than procedures such as crowning, bonding or veneering (Gupta, 2014). Recently lasers have also been tried for bleaching. It is a simple, fast, effective treatment to change discoloured teeth to lighter ones. This non-invasive procedure works wonders for the acceptance and self-confidence of the patient as it is appreciated through an immediate visual impact. The effect of bleaching agents on the properties of the restorative materials is important. Several studies have evaluated its effect both on the mechanical and physical properties of restoratives. However, investigations on surface roughness and microhardness of composites after bleaching treatment have shown contradictory results (García-Godoy, 2002).

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MATERIALS AND METHODS

10 mm of prefabricated Silicon moulds were customised to gain samples of thickness of 4 mm. Moulds were marked at 6mm from the base and filled with self -cured acrylic resin. Thereby leaving 4 mm of space at top for sample preparation. Samples were divided according to the filler content of composite. Three different composites were used.

S. No.	Group	Type of composite	Number of samples
1.	Group A	Nanofilled composite	20
2.	Group B	Nanohybrid composite	20
3.	Group C	Microfilled composites	20

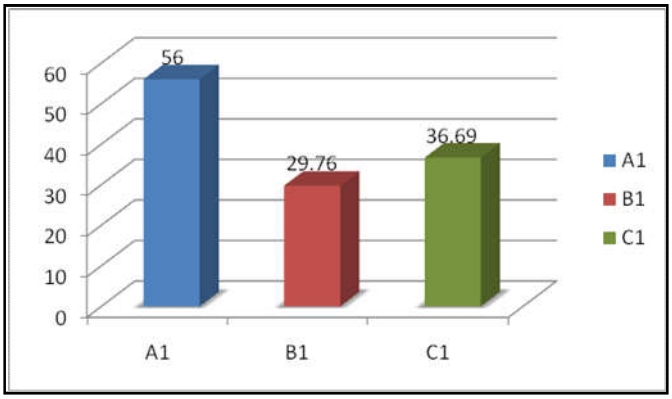
Prepared stock moulds were cleaned. Petroleum jelly was applied on the base as a separating media. The mould was filled with composite using Teflon coated instrument (GDC, India). Mylar strip was placed on top and pressed into position to provide even surface. After that light curing was done using LED curing light ((LCU) Rotex, India) having light intensity of 1000mw/cm^2 for 20 seconds with standard curing mode. Then the samples were retrieved immediately. All specimens were stored in distilled water for 24 hours at 37°C to assure complete polymerization. All the samples were measured using Vernier callipers to confirm the uniform thickness of specimens. Mounting of samples was done on acrylic resin using the moulds. Finishing and polishing of the sample was done with Super Snap Kit Discs (SHOFU INC. Kyoto, Japan) in a sequential manner of progressively finer grits, in a dry continuous manner with a slow speed contra-angled hand-peice (NSK) operating at 10,000 RPM for a total time of 80 seconds, i.e., 20 sec/disc in a planar motion on the various parts of the samples. The super-snap discs were centered over a single area for 10 sec to ensure that finishing and polishing was carried out in all area of the samples. Total of 60 samples (20 of each composite) were made in similar manner.

The specimens in each group were treated with bleaching agent. The bleaching agents was painted onto the specimens' top surface with an applicator tip and kept for 8 hours per day at room temperature to simulate the bleaching process. After bleaching, the specimens were rinsed with tap water for 1 minute to remove the bleaching agent, blotted dry and kept in distilled water at 37°C. The process was repeated for 21 consecutive days. Microhardness testing was done in two stages- before bleaching and after bleaching. After the preparation of samples, microhardness of each sample was noted. Microhardness of each specimen was measured at three separate locations randomly from each other and a mean was reported for each specimen. After the bleaching procedures were complete, microhardness values of the specimens were recorded at three separate locations randomly from each other and a mean was reported for each specimen, and compared with the initial values.

Statistical Analysis

A mean was reported for each specimen before and after bleaching and the initial values were compared to the values post bleaching. Also the values of all three composites were compared with each other. Statistical analysis was done using One way Anova test and Students t test. Table and graph shows that in A the scores after treatment were 56 which higher when compared with B (29.76) and C (36.69) and all these differences were found significant on comparison by one way ANOVA. Further on pair-wise comparison the difference was found significant with-in all the groups.

	N	Mean	Std. Deviation	p-value
A	10	56.00	3.30	0.001*
B	10	29.76	2.98	
C	10	36.69	1.68	
A			B	0.001*
			C	0.001*
B			C	0.001*



DISCUSSION

The consciousness of aesthetic appearance in society is increasing. Aesthetics is of great importance to the patients, including tooth color. In UK it has been reported that 28% of adults are dissatisfied with the appearance of their teeth. And in USA 34% of an adult population are not satisfied with their current tooth color and wants to change it. Today, by taking full advantage of new materials and technique, dentists can often meet or even exceed such expectations (Bailey and Swift 1992). Bleaching is one of the most commonly sought effective dental procedures to brighten smile. Nightguard vital bleaching (NGVB), or "matrix bleaching" or "dentist-prescribed/home-applied bleaching" has received much attention as an effective and simple method for lightening stained or discolour teeth (Frysh, 1995). Since Haywood and Heymann (Haywood and Heymann, 1989) first reported this technique in 1989, several studies have documented its success and effectiveness. This non -invasive procedure works wonders for the acceptance and self-confidence of the patient as it is appreciated through an immediate visual impact. These days, composite resin is one of the most popular dental restorative materials. It has a superior aesthetic, conservative tooth preparation compared to dental amalgam. Hence, it is widely used for anterior and also posterior restorations. Due to this, it is important to know the effects of bleaching on composite restorative material. When Group A1, B1 and C1 were compared microhardness reduction was seen in all the groups after application of bleaching agents. The least reduction in microhardness was seen with nanohybrid composite A followed by microfilled Cand nanofilled B. Bailey and Swift (1992) (Bailey and Swift, 1992) evaluated the effect of three representative bleaching products (White &Brite, Proxigel and Natural White) on the microhardness and surface texture of hybrid (Herculite XR (Kerr/Sybron Corp)) and microfilled composite resins (Silux Plus (3M Dental Products Div)). Microfilled composite resin, had extensive cracking after treatment with either Proxigel or White &Brite, both of which are 10% carbamide peroxide gels. Also, the surface of Herculite XR, a hybrid composite resin, was slightly rougher after treatment with White & Brite. Some softening of both composite resins occurred after treatment with home bleaching agents. Raji Viola Solomon, *et al*, in 2016 (Solomon *et al*., 2016) evaluated the microhardness of different direct resin-based restorative materials on using 10% carbamide peroxide gel as a bleaching agent (micro hybrid resin composite (Z250), a nanofilled resin composite (Z350), a hybrid resin composite (Z100)). They concluded that a 10% carbamide peroxide bleaching agent had an adverse effect on the micro hardness of nanofilled and hybrid types of resin-based composite materials compared with the micro hybrid type. The results can be explained by the fact that the filler load is related to the surface

roughness and microhardness of the restorative materials. The increased surface roughness may be attributed to erosion of resin matrix from free radicals of peroxide which leads to debonding of resin-filler interfaces and to dislodgment and elution of fillers. Consequently, the higher the volume and the size of leached particles of the materials, the rougher the resulting surface therefore decreased microhardness (ŞebnemBegümTurker and TuranBiskin, 2003).

Conclusion

There was a statistically significant decrease in the surface microhardness of both resin composites, nanohybrid and microfilled, and the difference was statistically significant. Whereas the increase in nanofilled composite was not statistically significant.

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