

Original Research Article

“Effect of Dental Bleaching on the Composite Filling Material’s Color – An *in vitro* study”

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Accepted, 28th June, 2018.

Introduction: Recent researchers have discovered that the two main bleaching products; carbamide peroxide (CP) and hydrogen peroxide (HP) have been affecting the physical conditions dental restorations for example, its surface roughness, ion leakage, hardness and color. **Materials and methods:** This is an experimental study, which aimed to assess the possible change in shades of A-1 and B-3 composite material. We selected two types of bleaching materials, with one consisting of 15% and the other with 22% carbamide peroxide. **Results:** The box plot shows the spread of color change for the two groups after bleaching with 15% and 22% carbamide peroxide through five statistics, minimum, first quartile, median, third quartile, and maximum. **Conclusion:** The concentration and composition of bleaching materials have an effect on the possible color change of the composite filling materials.

Keywords: Dental bleaching, Tooth discoloration, Shade change.

INTRODUCTION

Dental whitening is now widely available and many people are utilizing it to improve their dental appearance. The greater proportion of people is fantasized by whiter teeth. The remaining people want to get rid of the core discoloration due to pulpal necrosis, smoking, fluoride, tetracycline, or drinking red wine, coffee or tea. Due to this increase, the utilization of bleaching techniques and the modern bleaching items being introduced have led people to study their pros and cons on teeth and restorative materials.

Recent researchers have discovered that the two main bleaching products; carbamide peroxide (CP) and hydrogen peroxide (HP) have been affecting the physical conditions dental restorations for example, its surface roughness, ion leakage, hardness and color. This article is designed to give medical practitioners practical evidence when the changes restorative materials are administered in clinical point of view so that patients can be guided and explained the possible consequences (Philpotts, 2017).

The recent researches report that features of composite resin is affected due to bleaching, which is usually used for appealing dental managements e.g., surface hardness, roughness, staining susceptibility, elution, microleakage, and color. The team examined after whitening the teeth with 15% CP and found noteworthy alterations in the color of nanohybrid

and packable composite resins. More damage was noted when the teeth were whitened by increased concentrated of 35% Hydrogen Peroxide which affected low-density resins, e.g. microfilled composite resin. The changes were also affected by the volume of resin matrices and filler type. But the results of both experiments were clinically up to the standard.

Nowadays, patients have been prioritizing their appearance than other factors. Highly discolored teeth are being for a long time through different methods; crowns, direct and indirect veneers, composite resin restorations, and highly predictable bleaching. In office and take home techniques, both are trending recently with variable results. The classical in-office bleaching technique consists of highly concentrated hydrogen peroxide applied to the teeth exterior and then activating it either with the help of chemicals or an illuminating source. With the help of light, the solution of hydrogen peroxide is heated which increases the rate of decomposition of oxygen. Greater the number of oxygen radicles are produced better will be the whitening of the teeth as they release the molecules of the stains.

The formulation used in these techniques lead a polymerization reaction due to which the composite resin restorative material experience couple of bodily alterations. These techniques also result in softening of the resin matrix

and decrease of stain resistance. Intrinsic and extrinsic factors play a role in discoloration of tooth-colored resin-based materials. Resin material is itself decolorized due to intrinsic factors, for e.g., the interface of matrix and fillers and changes of the resin matrix. Extrinsic factors for e.g., adsorption or adsorption are also capable of causing discoloration. It is also recorded that different type of materials offer different levels of stain resistance. Coffee and red wine appeared to be the strongest causes of discoloration as compared to other causatives. Adsorption of colorants by the tested materials is the main reason for discoloration caused by coffee (Alqahtani, 2014).

Bleaching agents are used to enhance the exterior looks of natural teeth and have lately been a trend in certain societies. Hydrogen peroxide (HP) and carbamide peroxide (CP) are the solutions used as bleaching agents. Whitening of teeth structure through bleaching is due to the decomposition of peroxides into unstable free radicals. Later by oxidation or reduction, radicals are converted into large pigmented molecules. The change in color is brought by the oxidation or reduction process that alters the organic substances of the tooth. But the bleaching agents can affect the human teeth and the restorative material used. Studies are being made for the effect on dental restorative material by bleaching. As the organic materials are composed of resin materials, it is more affected by the chemical reactions as compared to ceramic restorations and inert metal. Minimal damage can be exhibited by using low concentrated CP formulated solutions whereas the higher concentrated CP of solution damage the enamel of the teeth. Surfaces of already placed composite restorations and prompt bacterial growth due to bleaching.

Today, in the aesthetic dentistry, teeth's whitening is considered one of the most popular methods. This is so because it is considered as being the most effective procedures in the clinic. Although over the period of time it was considered as being very safe in usage but now there have been certain issues which have arisen with respect to the restorative material. While carrying out the procedure of whitening special attention should be paid on the effect it creates on the corrosive, physical and mechanical properties. The alterations in the properties of the materials can have several implications and this is because the longevity and the prognosis usually depend upon such issues.

The bleaching of the tooth has become one of the most well accepted and successful treatment in the aesthetics over the period of time. There have been several methods which have been associated with the discoloration of the teeth. Today the tooth bleaching has become one of the most desired and wanted treatment in the treatment of the improving aesthetics. A report which was published by the Clinical Research Associates stated that today 91% of the dentists provide teeth bleaching in their treatments and out of them, 71% were always successful.

The teeth whitening have become more and more accessible to people, a lot of patients select this procedure for aesthetic reasons. The major reason is the fact that people want whiter teeth. On the other hand, the patients also want to get rid of the discoloration which is caused by the several extrinsic and intrinsic sources. The advancements in the bleaching which is taking place every year, several dentists have started studying the effect that all these products have on the teeth.

The appearance of the aesthetics teeth today has become one of the most major concerns for the people today. The discoloration of the white teeth has been approached and treated in various other ways over the period of time such as

bleaching, crowning, resin restorations and indirect and direct veneers. The ideas of in-office bleaching and take home bleaching have both turned out to be very effective and they also give out the advantage of providing with immediate results.

When resin is used as a restorative material for the treatment it undergoes several changes which are physical and are a result of the polymerization reaction. They are also the result of the continuous interaction with the wet surface. This does cause the softening of the resin and the resistance which is caused. The use of famous agents which act in the bleaching have become very popular in the era since they were introduced by the Heymann and Haywood. The bleaching agents being used today are based on the Hydrogen Per Oxide and its several compounds. The bleaching is carried out because of the agents which provide the tooth structure and the free radicals which move around.

The stability of the color is considered as one of the most major factor in the restorations which take place. The stability of the color is defined as the capability of the material to recollect the color it had over the period of certain time and in an environment which is fixed. To make sure that the restorative material that is being used remains in the best manner possible should mean that such a product should be used which has the best color stability. It has been proved that over the period of time both the intrinsic and extrinsic properties play a vital role in the contribution to the restorative material.

AIMS OF THE STUDY

- To determine the effect of 15% and 22% carbamide peroxide on composite shades A-1 and B-3.
- To determine the extent of color change.

MATERIALS AND METHODS

This is an experimental study, which aimed to assess the possible change in shades of A-1 and B-3 composite material. We selected two types of bleaching materials, with one consisting of 15% and the other with 22% carbamide peroxide. We made 12 discs (1 mm in thickness), which were divided into the following groups:

- A-1 exposed to 15% carbamide peroxide (3 in quantity).
- A-1 exposed to 22% carbamide peroxide (3 in quantity).
- B-3 exposed to 15% carbamide peroxide (3 in quantity).
- B-3 exposed to 22% carbamide peroxide (3 in quantity)

Home bleaching materials were used and due to their slow mechanism of action, we exposed the composite discs in each bleaching material for 320 hours in total.

Color Testing

We decided to get the shade change tested by multiple examiners; there we selected 3 senior dental students randomly. These examiners did not know the actual shade of the composite. They were asked to examine each composite

disc and choose the most matching tooth shade using Vita classical shade guide. The readings were recorded for each examiner and used to analyze the results by SPSS (Statistical Package for Social Sciences) version 22.

RESULTS

The box plot shows the spread of color change for the two groups after bleaching with 15% and 22% carbamide peroxide through five statistics, minimum, first quartile, median, third quartile, and maximum. The box represents the inter-quartile range. The line that creates the bottom of the box represents lower quartile, or quartile 1, and the line that creates the top side of the box represents the upper quartile, or quartile 3. The line in the middle of the box is the median. The horizontal line on the far bottom is the extreme minimum value, and the horizontal line on the far top is the extreme maximum value. These are the smallest and the largest numbers in the data set. Finally, the line that extends vertically from the extreme minimum to the extreme maximum represents the range of the data set (Figures 1 and 2).

Inter-examiner Reliability

Since the samples were examined by multiple examiners so we conducted a test to measure the inter-examiner reliability. Kappa was used for this purpose and we found that the inter-examiner agreements ranged from 75-100%.

DISCUSSION

There is evident proof that bleaching has an effect on the color change of composite materials. Since A-1 is the lightest shade of composite, it was much convenient to assess the change in color after being exposed to different concentrations of home bleaching materials. 15% carbamide peroxide did not have an effect on A-1 shade; whereas 22% had an effect on color.

However, shade B-3 showed more change when exposed to both types of bleaching materials. It is debatable that the time of exposure can be of great importance. We found similar results from a study conducted by Villalta et al (2006), where they found a distinctive color change in composite materials. Another study conducted by Hubbezoglu et al (2008), exhibited similar findings where they found a significant change in composite shades.

The results obtained showed that the kinds of effect bleaching had on the restorative materials might be dependent greatly on the material which is being used. The bleaching procedure is usually more resistant to the materials such as the composite resin, gold alloy and also to the dental ceramic used. It was concluded that the minor bleaching effects could be seen and experienced if the materials which are mentioned could be polished after the procedure so that the optimum level could be achieved. The physical properties of the several other materials could be altered in the bleaching process and that included the materials such as the glass ionomer, compomer and cement.

Given the accessibility of 2 sorts of peroxide in different fixations, the absence of accord about the impacts of blanching specialists on therapeutic materials among the writers of the research center examinations audited in this article isn't shocking. Dental practitioners ought to know that the physical properties of some dental reclamation might be adjusted subsequent to dyeing. They ought to likewise ensure that their patients with dental rebuilding efforts know about the progressions that may happen amid brightening, and

additionally the likelihood that their dyed reclamations may be cleaned or supplanted toward the finish of the treatment.

Three in-office dying specialists had no huge shading changes on two composites. DF indicated more shading change than TPH when inundated in espresso. Recolored composites demonstrated diverse degrees of brightening, with DF indicating more reaction. Dying may unfavorably influence the surface of composites. Dental practitioners should contemplate that composite rebuilding efforts may not react to dyeing similarly that common teeth do.

Dental therapeutic materials are presented to spit, stains, nourishment parts, and refreshments in the oral condition. Routine nourishment propensities can influence the tasteful nature of composite rebuilding efforts. To guarantee brilliant feel, it is vital for tooth-hued materials to keep up natural shading strength and a protection from surface recoloring. In any case, after some time, composite reclamations do procure outer stains and inside staining. This could be ascribed to either material being biphasic; that is, made out of network and filler particles which gives extent of incorporation of outside stains in its structure or different nourishment things, for example, tea, espresso, tobacco, and turmeric (a typical fixing in Indian cooking), being immersed with colorants.

Today "more white teeth" is the most widely recognized tasteful demand from dental patients and tooth brightening is a generally noninvasive way to deal with accomplishing this objective. As blanching of teeth has turned out to be to a great degree famous, the impact of fading on stylish appearance of dental materials must be considered. This confounds the way toward endeavoring to build up and keep up great shading match between the dental rebuilding and the contiguous tooth structure. Changes in the concoction and morphological structure of rebuilding efforts must be of concern while dying is utilized as a brightening treatment.

The staining of helpful materials is subject to different parameters, for example, the pH estimation of the recoloring arrangement. The lower pH benefit of recoloring arrangements is accounted for to build recoloring as contrasted and chlorhexidine, which is less acidic.⁴³ Comparable outcomes were found in the present investigation. Espresso, having the best pH in the four recoloring arrangements utilized as a part of the present examination, initiated the slightest shading changes on both dyed and control examples. Red wine (Normal pH=3.73) created more serious staining than homegrown tea (Normal pH=4.91).

CONCLUSIONS

The concentration and composition of bleaching material has an effect on the possible color change of the composite filling materials.

CONFLICT OF INTEREST

None of the authors as well as outside personnel or organization has any conflict of interest in the publication of this study.

Table 1: Descriptive analysis (A1)

	A1	
	15%	22%
Median	A1	B1
Range	A2	B1
Interquartile range	B2	B1
Minimum	B1	B1
Maximum	C1	A1

Comparing the median values, 22% concentration showed a change in the color from A1 to B1 and 15% showed no color change.

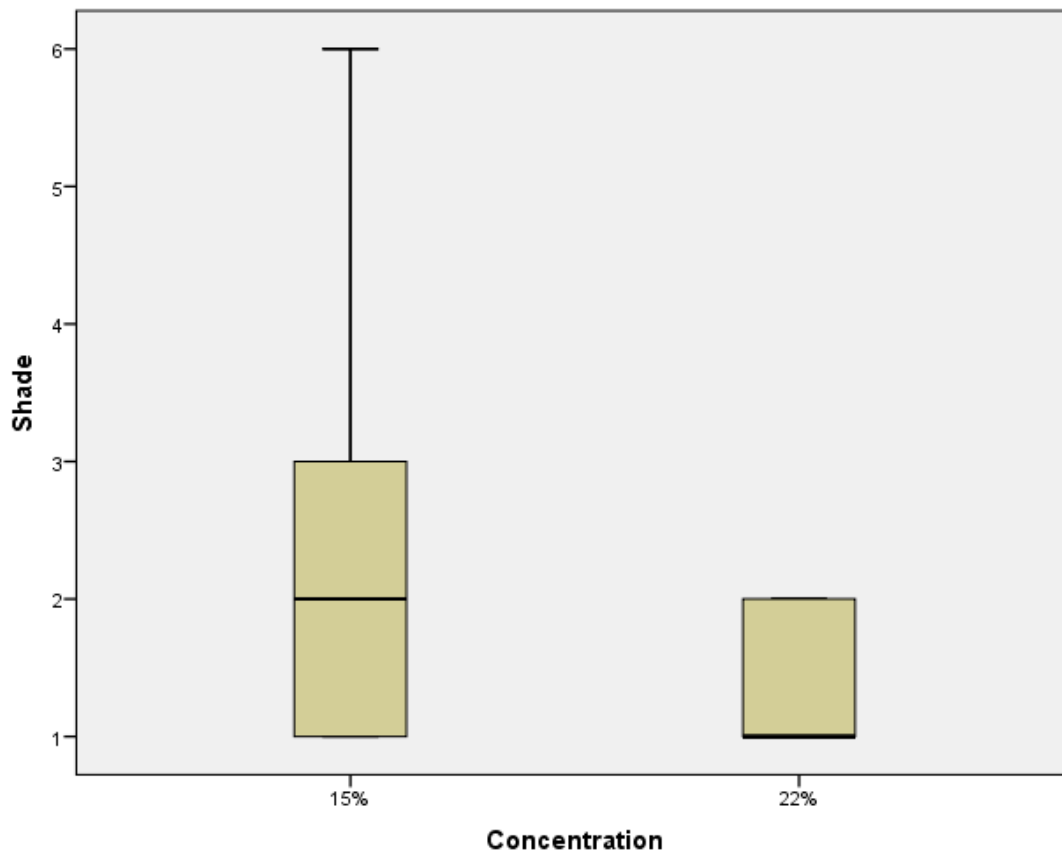


Figure 1: Box plot (A1)

Table 2. Descriptive analysis (B3)

	B3	
	15%	22%
Median	C2	A2
Range	A3	D4
Interquartile range	A2	A2
Minimum	B2	B2
Maximum	A3.5	B3

Comparing the median values, 22% concentration showed a change in the color from B3 to A2 and 15% showed B3 to C2. At 22% concentration, B3 shade showed more color change.

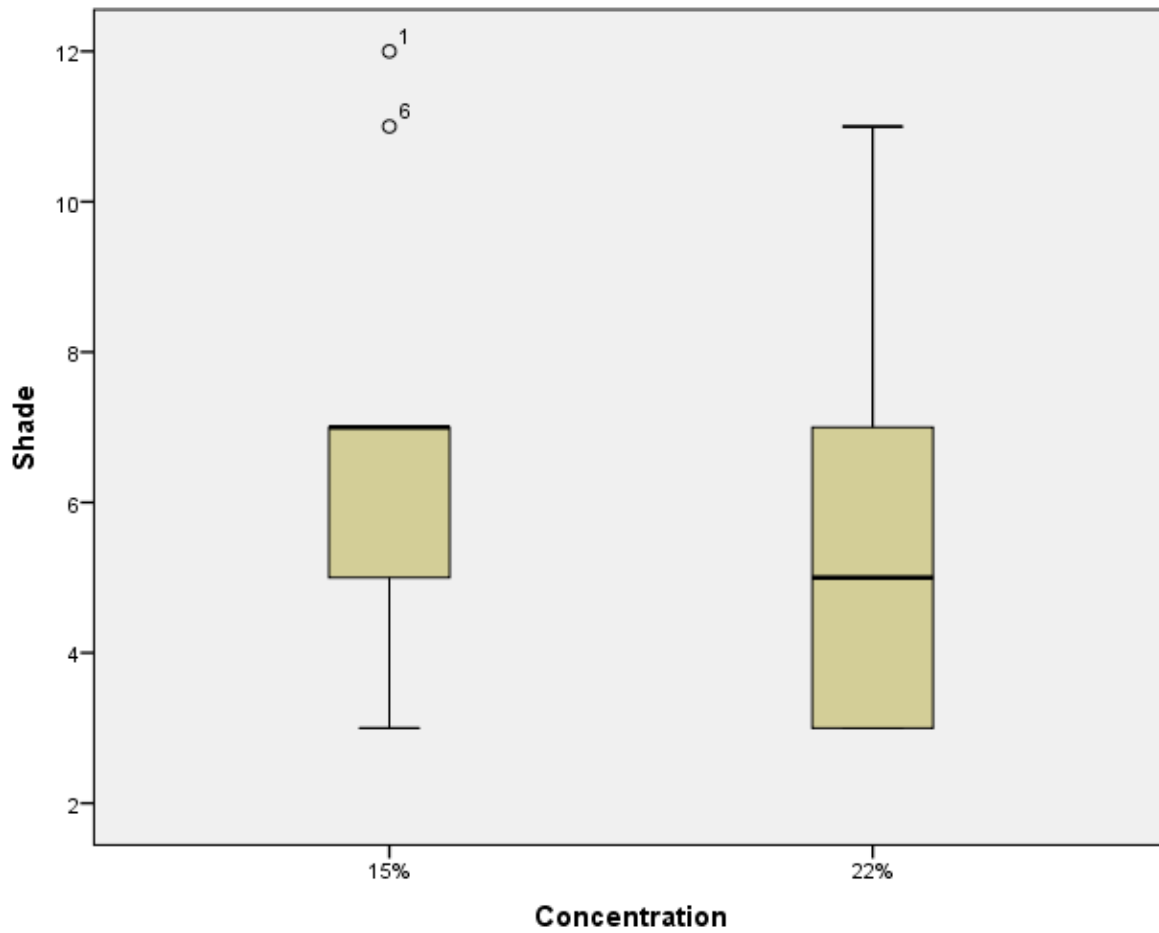


Figure 2: Box plot (B3)

Table 3: Test of statistical significance

Test Statistics ^a		
	A1	B3
Mann-Whitney U	27.000	30.500
Wilcoxon W	72.000	75.500
Z	-1.325	-.902
Asymp. Sig. (2-tailed)	.185	.367
Exact Sig. [2*(1-tailed Sig.)]	.258 ^b	.387 ^b
a. Grouping Variable: C		
b. Not corrected for ties.		

The color change in A1 and B3 shade between 15% and 22% was statistically not significant ($p > 0.05$).

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