

## ORIGINAL RESEARCH

### Evaluation of Effect of Bleaching Agents on Composite Colour- An in Vitro Study

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#### ABSTRACT:

**Background:** The use of bleaching agents to improve the appearance of natural dentition has become a popular procedure. The present study was conducted to evaluate effect of bleaching agents on color of composite. **Materials and Methodology:** It comprised of 30 permanent first molars. Teeth were stored in physiological serum. Two class V cavities measured 5 mm high, 5 mm wide and 2 mm deep were created in each tooth with a cylindrical diamond bur with water cooling. Initial quantitative colour ( $\Delta E$ ) measurements were performed by the use of a spectrophotometer using formula-  $\Delta E = [(\Delta L^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2]^{1/2}$ , where  $L^*$  represents lightness,  $a^*$  redness-greenness and  $b^*$  yellowness-blueness. This formula provides numeric data that represent the differences in colour perceived between 2 objects. The specimens were then randomly divided into 3 groups of 10 each. Group I specimens were treated with 10% Carbamide peroxide for four hours per day for two weeks, group II specimens were treated with 9% hydrogen peroxide for four hours per day for two weeks and group III, specimens were stored in artificial saliva (Control) at 37°C for two weeks and served as control. All specimens were measured three times and the average values were calculated. **Results:** The results of color measurements between all the groups was statistically insignificant ( $P > 0.05$ ). **Conclusion:** Authors found that 9% hydrogen peroxide had the highest colour change when compared to 10% carbamide peroxide and artificial saliva. However the results were statistically insignificant with the control group.

**Key words:** Composite, hydrogen peroxide, Carbamide peroxide,

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#### INTRODUCTION:

The use of bleaching agents to improve the appearance of natural dentition has become a popular procedure since their introduction by Haywood and Heymann.<sup>1</sup> Currently, the bleaching agents are based primarily on hydrogen peroxide (HP) or its compounds such as carbamide peroxide (CP). The bleaching agents provide whitening of tooth structure through decomposition of peroxides into unstable free radicals.<sup>2</sup> These radicals further breakdown into large pigmented molecules either through an oxidation or a reduction reaction. The oxidation/reduction process changes the chemical structure of interacting organic substances of tooth, which results in color change.<sup>3</sup> Four different approaches for tooth whitening have been recognized such as dentist-administered bleaching—the use of a high concentration of hydrogen peroxide (from 35 to 50%) or carbamide peroxide (from 35 to 40%), often

supplemented with a heat source; (b) dentist-supervised bleaching—by means of a bleaching tray loaded with high concentrations of carbamide peroxide (from 35 to 40%) that is placed in the patient's mouth for 30 min to 2 hrs while the patient is in the dental office; (c) dentist-provided bleaching— known as "at-home" or "night-guard" bleaching and administered by the patient applying from 5 to 22% solution of carbamide peroxide in a custom-made tray; (d) over-the counter products, often based on carbamide peroxide or hydrogen peroxide of various concentrations are placed in a pre-fabricated tray, or by the recently introduced strips both to be used by the patient.<sup>4</sup> Currently available home bleaching agents often contain up to 10% hydrogen peroxide (HP) or 22% carbamide peroxide (CP) as active ingredients, but products containing 10% CP appear to be most popular. The effects of CP (home bleaching) on the surface microhardness are

material-dependent.<sup>5</sup> Significant increase in the surface microhardness of glass-ionomer cement after exposure to 15% CP was verified. HP decomposes in water into oxygen and free radicals. The free radicals are responsible for whitening the teeth through the oxidation of the pigments responsible for their discoloration.<sup>6</sup> The present study was conducted to evaluate effect of bleaching agents on color of composite.

**MATERIALS AND METHODS**

The present study was conducted in the department of Conservative dentistry. The study protocol was approved from institutional ethical committee.

It comprised of 30 permanent first molars. After removing any remaining tissue and plaque, the teeth were stored in physiological serum. Two class V cavities measured 5 mm high, 5 mm wide and 2 mm deep were created in each tooth with a cylindrical diamond bur with water cooling. The molars were then sectioned in mesial-distal direction with a diamond disc driven by a hand-piece, cutting each tooth

into two halves and cleaning the pulp chambers with a curette.

All sections were filled with composite resins as per manufacturer instructions. Initial quantitative colour ( $\Delta E$ ) measurements were performed by the use of a spectrophotometer using formula-  $\Delta E = [(\Delta L^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2]^{1/2}$ , where L\* represents lightness, a\* redness-greenness and b\* yellowness-blueness. This formula provides numeric data that represent the differences in colour perceived between 2 objects.

The specimens were then randomly divided into 3 groups of 10 each. Group I specimens were treated with 10% Carbamide peroxide for four hours per day for two weeks, group II specimens were treated with 9% hydrogen peroxide for four hours per day for two weeks and group III, specimens were stored in artificial saliva (Control) at 37°C for two weeks and served as control. All specimens were measured three times and the average values were calculated. Results thus obtained were subjected to statistical analysis. P value <0.05 was considered significant.

**RESULTS**

**Table I Distribution of tooth**

| Groups | Group I                | Group II             | Group III         |
|--------|------------------------|----------------------|-------------------|
| Agent  | 10% Carbamide peroxide | 9% hydrogen peroxide | Artificial saliva |
| Number | 10                     | 10                   | 10                |

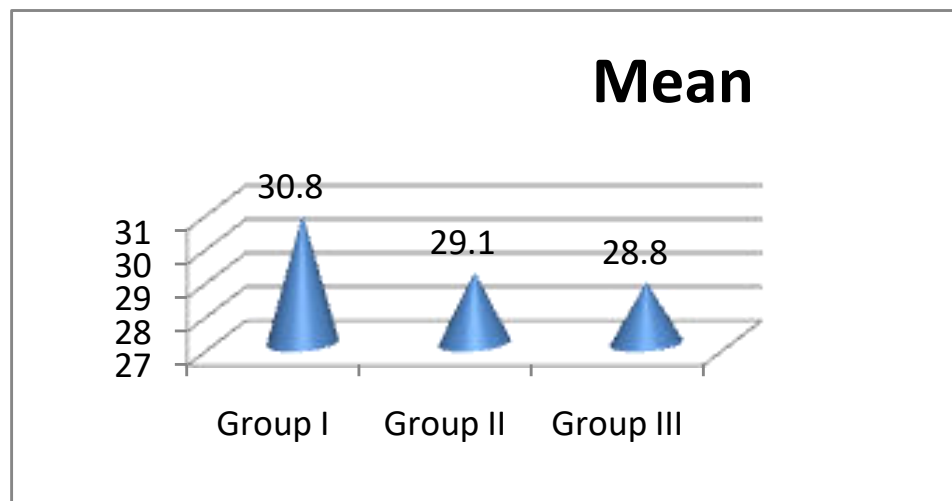
Table I shows that group I specimens were treated with 10% Carbamide peroxide, group II specimens with 9% hydrogen peroxide and group III, specimens were stored in artificial saliva.

**Table II Assessment of Color Measurements**

| Groups    | Mean | P value |
|-----------|------|---------|
| Group I   | 30.8 | 0.21    |
| Group II  | 29.1 |         |
| Group III | 28.8 |         |

Table II, graph I shows that the results of color measurements between all the groups was statistically insignificant (P> 0.05).

**Graph I Color Measurements**



## DISCUSSION:

Mixing sodium perborate with hydrogen peroxide had shown to accelerate the rate of colour change. In the case of severe discolouration, it is safe to mix sodium perborate with a 3% solution of hydrogen peroxide; however it is not appropriate to use 30% hydrogen peroxide because of the possible risk of inducing cervical root resorption.<sup>7</sup> Recently, sodium perborate in the form of strips and gels have been introduced which are available for home bleaching procedures. Bleaching agents deteriorate the surface of existing surface restoration which may induce bacterial adhesion.<sup>8</sup>

An alternative method was proposed by Heyman in 1989 which is a simple, apparently safe and comparatively inexpensive bleaching alternative for patients, commonly known as Night guard home bleaching technique.<sup>9</sup> It involves the application of mild bleaching agents on the teeth by wearing a custom made vacuum formed tray. To date, studies evaluating the effect of night guard bleaching agents on the colour change of composites has been scarce. The present study was conducted to evaluate effect of bleaching agents on color of composite. The composite material used in the study is a recently introduced microfilled hybrid composite Gaenial GC. The type of resin matrix present in it is urethane dimethacrylate (UDMA) which is claimed to be more stain resistant than bis-GMA.<sup>10</sup> In present study, group I specimens were treated with 10% Carbamide peroxide, group II specimens with 9% hydrogen peroxide and group III, specimens were stored in artificial saliva.

We found that the mean color change in group I specimens was 30.8, in group II specimens was 29.1 and in group III was 28.8. The result of color measurements between all the groups was statistically insignificant ( $P > 0.05$ ).

Simone et al<sup>11</sup> compared the color changes and microhardness of a nanocomposite after four bleaching regimens. Twenty-five specimens ( $n = 25$ ) were made with a nanocomposite resin (Filtek Supreme XT). The specimens were divided into five groups equally ( $n = 5$ ): bleaching groups and control group, as follows: G1: artificial saliva at 37°C; (control) G2: hydrogen peroxide (HP) at 7%; G3: hydrogen peroxide (HP) at 35%; G4: carbamide peroxide (CP) at 10%; G5: carbamide peroxide (CP) 35%. Color measurements were made with spectrophotometer using CIELAB color scale. The Vickers hardness (VHN) measurements were performed at the top surface. The data were analyzed with two-way Analysis of Variance.  $\Delta E$  and VHN mean values into the groups were not statistically different, however, the VHN mean values before and after storage and bleaching showed statistically significant differences.

Villalta et al<sup>12</sup> evaluated color changes to composite resins used to restore extracted teeth compared with composite discs after whitening with two agents: hydrogen peroxide (HP) and carbamide peroxide (CP). Ten human molars with class V vestibular and palatine cavity preparation obturated

with Vita hybrid nanocomposite were hemisected to obtain 20 specimens assigned randomly to two groups: O1 and O2. Twenty composite discs were divided into two groups: D1 and D2. The groups O1 and D1 were treated with 16% CP, while groups =2 and D2 were treated with 37.5 % HP. Chromaticity coordinates  $L^*$ ,  $a^*$  and  $b^*$  were registered using a spectrophotometer. Statistically significant differences were found in O1 for  $L^*$  and  $a^*$ , in O2 for all three coordinates, and in D1 and D2 only for  $L^*$ . Comparisons between groups found significant differences in  $\Delta E_e$  (end of treatment) between O1 and O2, between O2 and D2, and between D1 and O1.

## CONCLUSION:

Authors found that 9% hydrogen peroxide had the highest colour change when compared to 10% carbamide peroxide and artificial saliva. However the results were statistically insignificant with the control group.

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