

Clinical Evaluation of Bleaching Agents of Different Concentrations



Dr. Hakam Al-Musa
BDS, MSD Operative Dentistry
• Adjunct Assistant professor
University of Jordan
hmusa@musaclinics.com

Abstract

The purpose of this study was to evaluate the degree of color change of teeth, any rebound effect and sensitivities associated with using different concentrations of carbamide peroxide in an *in vivo* double blinded randomized prospective study. Twenty five subjects used 10% and 15% agents in trays for 14 days on different sides of their maxillary arches. Subjects returned in 3 days and at 1, 2, 3, and 6 weeks for evaluation. The use of 15% carbamide peroxide initially achieved significantly greater tooth lightness than the 10% carbamide peroxide. This difference was however insignificant by the end of the study, indicating that the use of either concentrations will eventually yield the same degree of tooth lightness, with comparable tooth and/or gum sensitivity.

Key words: Vital bleaching; carbamide peroxide; discolored teeth; color relapse.

The popularity of the night guard or home bleaching technique for vital teeth has stimulated manufacturers to produce a large number of products for this purpose. The first article on bleaching teeth using night guard vital bleaching (NGVB) technique was published in 1989¹, but the technique can be traced back to 1968.² The technique involves the use of a 10% carbamide peroxide material applied in a custom mouth guard for certain number of hours per day or night for a two-to-six week treatment regimen.³ A 10% carbamide peroxide material contains approximately three percent hydrogen peroxide (H₂O₂) and seven percent urea.

The purpose of this study was to compare the effects of 10% and 15% fluoridated carbamide peroxide. It was hypothesized that there will be faster color change and more tooth and tissue sensitivity using the higher concentration of carbamide peroxide.

Material and Methods

This randomized double blinded prospective clinical trial involved 25 patients who desired having their teeth whitened. After getting an ethical committee approval, seventeen non-pregnant nor lactating females and eight males, between 26 and 73 years of age participated in this study. All participants were medically healthy, didn't use in office nor mouth guard vital bleaching in the past three years, didn't use tobacco during the past 30 days and refrained from the use of tobacco products during the study period and had all maxillary anterior teeth without tetracycline staining.

Ten and fifteen percent fluoridated carbamide peroxide from Opalescence (Ultradent products, South Jordan, UT, USA) (Fig. 1) were compared by evaluating the degree of color change of teeth, any post-bleaching rebound effect associated with discontinued use of bleaching material, and any gum or tooth sensitivity associated with the use of different concentrations. A cast was fabricated after an impression was taken. The labial surfaces on the cast were blocked (Fig. 2) and a custom mouthguard was fabricated (Fig. 3). The 25 maxillary arches were split into two halves for each concentration to be tested. The subjects were given a dental screening and prophylaxis prior to the beginning of the study. Bleaching of the lower jaw was performed at the end of the study.

The operator evaluated the degree of color change in treated teeth by subjective shade matching using a shade guide (Fig. 4), by photographic means (Fig.5) and by measurements obtained with a lightness measuring device—Minolta Chroma Meter CR-321 (Minolta Corporation USA, Ramsey, NJ, USA). These tests were performed at baseline, at third day, at first, second, third and sixth week after bleaching.

Gum and tooth sensitivities were evaluated by asking patients to daily record for three post-operative weeks any sensitivity they experienced. Subjects self-reported on scale of 1 (no sensitivity) to 5 (severe sensitivity). Patients who had more than moderate amount of sensitivity were given a potassium nitrate desensitizing gel-UltraEZ (Ultradent products, Inc., South Jordan, UT, USA).

Results

Twenty five patients completed this study. The color change and relapse effects were evaluated by using a colorimeter, shade guide, and by photographic means. During the 3, 7, 14 and 21 days, the Chroma Meter data for the 10% and 15% carbamide peroxide showed statistically significant differences. The differences were however statistically insignificant at the end of the study. The 15% concentrations demonstrated faster and greater color change compared with 10% during the active treatment period (first two weeks).

Color relapse, measured using the three methods mentioned above, started when patients discontinued using the bleaching material. All concentrations showed fast rates of relapse during the third week of the study (one week post-bleaching), after which the 10% showed minimal change until the end of the study (4 weeks after the end of the active treatment). The 15% group continued to show color relapse at a higher rate compared with the 10% group until the end of the study.

Subjective shade matching using the Trubyte Bioform Color Ordered Shade Guide was done. Twenty four shade units were arranged according to Value, Chroma, and hue as recommended by the American Dental Association. According to the results, change in shade guide rank was significantly different for the 10% and 15% products during the study period, but not at the end of the study.

Sensitive photographic evaluation was done in this study by two calibrated restorative dental evaluators using slides. In this method of evaluation, the 15% group showed more lightness for days 7, 14, and 21. The products were not different in days 1, 3, and 45.

Some patients experienced mild gum or tooth sensitivity that lasted for few days and then disappeared. There was no difference between the 10% group and the 15% group concerning the severity of the sensitivity.

Discussion

Bleaching has been accepted as one of the methods of treating discolored teeth. The increased popularity of home bleaching is related to the good aesthetic results that have been achieved by using night guard vital bleaching (NGVB) and to the safety of these dentist supervised products. Bleaching is considered a more conservative approach to obtain aesthetic or cosmetic results when compared with the more aggressive methods such as veneers, crowns, or bonding.

It is important that NGVB be professionally supervised. A health professional must first diagnose the cause of discoloration⁴ and can take base line radiographs to determine if periapical pathology exists and to assess variation in pulp sizes. Logically, we would expect more sensitivity with larger pulp sizes. It is noteworthy that no clinical studies were done on children to evaluate the whitening effect on the pulp and accordingly the recommendation is to proceed with whitening treatment not earlier than 18 years of age, till more research is done on this age group.⁵ A health professional is able to evaluate any side effects a patient may experience and determine if bleaching is the most appropriate cosmetic therapy.⁶ A health professional should assess any composite restorations or crowns the patient may

(Figure 1) ▶

Two concentrations of Opalescence bleaching material 10 and 15% carbamide peroxide with fluoride as supplied by the manufacturer.



(Figure 2) ▶

The labial surfaces were blocked out with LC Block-Out resin.



(Figure 3) ▶

The custom maxillary mouthguard.



(Figure 4) ▶

Trubyte bioform color ordered shade guide.



(Figure 5) ▶

Slide photograph using Elite 100, 35-mm film (Kodak, Rochester, NY).



have on the teeth that are being considered for bleaching.⁷ Periodontal health should be evaluated and treated if needed before any final decision on whitening treatment. Finally, a health professional has access to the best bleaching and mouth guard materials available and can make a custom-fitted mouth guard.⁵

NGVB was so named because the patient wears the bleach during the night. Some companies advocate night time wear, whereas other companies propose one to two hours intervals of treatment during the day, because their products did not contain Carbopol. Carbopol makes the material thicker and stickier and slows the release of oxygen.⁵

Patients' compliance with night time wear is generally better than that with day time wear, especially in extended treatment situations.⁸ Occasionally, patients may need to reduce treatment duration to day time wear as a result of sensitivity, of life style changes, or because they prefer day treatment.⁵

Research has been accomplished to evaluate the safety and efficacy of bleaching agents.⁹⁻¹¹ Repeated clinical trials have shown minimal significant adverse effect from using dentist monitored home bleaching agents. A review of the literature has shown that peroxide-containing bleaching agents have been used safely in oral application for years.¹⁰ The cases of mucosal irritation are generally caused by the tray and not the bleaching agent. Clinical and laboratory studies have shown that 10% carbamide peroxide tooth whitening lightens teeth effectively and causes noticeable changes in the shade of teeth.¹²⁻¹⁴ An in vitro study done by Jones *f.* showed that 20% carbamide peroxide Opalescence (Ultradent products Inc., South Jordan, UT, USA) caused greater perceptible change in color compared with 10% carbamide peroxide Opalescence.¹⁵

Studies have shown that bleaching procedures generally do not affect the mechanical properties of enamel¹⁶ or dentin.¹⁷ Other studies demonstrate that there is no change in enamel morphology as a result of using bleaching agents.¹⁸ The effect of bleaching agents on bond strength to enamel has been studied. Bleaching by 35% H₂O₂ or 10% carbamide peroxide reduces the bond strength of composite to enamel and can reduce the bond strength of Glass Ionomer. The primary cause for reduced bond strength is probably the presence of residual peroxide or oxygen, which interferes with the polymerization of the resin bonding system and restorative material.⁹

Recommendation is to complete the restorative treatment after whitening in the aesthetic zone to match the new color of teeth. Whitening treatments will not change the shade of an existing restoration. Waiting for a period of two to four weeks before placing a restoration is recommended in order for the shade of the natural tooth to stabilize after whitening and to negate the effect of residual peroxide which interferes with the resin polymerization.

The effect of carbamide peroxide on composite has little or no effect on color, surface roughness, strength, or hardness. The effect of carbamide peroxide on amalgam showed larger amounts of mercury release.⁹ Bleaching agents have no effect on color or physical properties of ceramics.⁹

Side effects from the bleaching procedure, such as tooth sensitivity, may be related to low water content of the bleaching agent, resulting in dehydration of the dental hard tissue.¹⁹ It is conceivable that protective or desensitizing varnishes applied prior to bleaching may prevent water loss from dentin by dehydrating bleaching agents.²⁰ Varnishes, such as Vivasens (Ivovlar-Vivadent, Schaan, Liechtenstein), Seal & Protect (Dentsply DeTrey, Konstanz, Germany) or Bifluorid (Voco, Cuxhaven, Germany), did not compromise the bleaching effect of subsequently applied bleaching gels.²¹ Using varnishes, fluoride gel, or toothpaste for sensitive teeth, before and/or after whitening treatment will help in reducing the amount of sensitivity a patient might experience. Using fluoride gel in a tray for few days before treatment for three to four hours daily and

applying topical fluoride treatment for two to four minutes immediately before and after whitening procedure will reduce the chances of sensitivity for office or home whitening procedures. The continuous use of toothpaste for sensitive teeth after treatment for a week or two would be ideal in controlling teeth sensitivity especially for patients already suffering from sensitive teeth before treatment.

This clinical study compared two different concentrations of home whitening materials, (10% and 15% carbamide peroxide) in relation to 1) their ability to lighten teeth, 2) the relapse of color that occurs after discontinued use of the products, and 3) the amount of tooth and gum sensitivity that occurs with their use.

The use of 15% carbamide peroxide initially achieved greater tooth lightness when compared to the 10% carbamide peroxide. Although this difference was initially significant, it however became insignificant by the end of the study (at 6 weeks). The greater achieved lightness during the active bleaching period was actually followed by a greater color relapse once the bleaching gel was not used. There was no significant difference in tooth or gum sensitivity with either concentration. Accordingly, it may be concluded that the use of either concentration will eventually yield the same degree of tooth lightness, with comparable tooth and/or gum sensitivity.

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