

Continuing Education

The Baltimore College of Dental Surgery, University of Maryland Dental School

Vital Tooth Bleaching: An Update

Howard E. Strassler, DMD

Learning objectives:

After reading this article, the reader will be able to:

- List the different types of vital tooth bleaching systems that are professionally dispensed
- List the different types of over-the-counter tooth whitening systems
- List the esthetic conditions that can be treated with vital tooth bleaching
- Describe the adverse reactions that have been associated with vital tooth bleaching
- Describe at least three different ways to manage bleaching-related tooth hypersensitivity
- Describe how to manage bleaching relapse



Howard E. Strassler, DMD, is a professor and director of operative dentistry in the Department of Endodontics, Prosthodontics and Operative Dentistry at the University of Maryland Dental School. You may contact him at: 650 W. Baltimore St., Baltimore, MD 21201; phone: 410-706-7047; e-mail: hstrassler001@umaryland.edu.

INTRODUCTION

Today's dental patients are better educated than in the past. There has been an increase in the ability of patients to understand what dentistry has to offer because television and print media have provided our patients with insights on the latest advances and research in dentistry, including periodontal disease and its implications with heart disease, lasers, CAD-CAM, implants, white fillings, porcelain veneers, and tooth whitening, among others. Also, the Internet provides patients with access to information on the advances in dentistry.

One major area that our patients are requesting more information on is esthetic dentistry. The types of dental services to enhance personal appearances have increased over recent years with the boom in esthetic dentistry. With the increase in patient awareness of the ability to improve their smiles as presented on national television, patients have accepted and like the concept that they can change the appearance of their smiles with only a few visits to the dentist. Esthetic dentistry is elective. It is no longer necessary for patients to be dissatisfied with the appearance of their smiles. Esthetic restorative dentistry includes many treatment modalities to change the appearance of teeth. These treatments range from the routine placement of composite resin restorations, porcelain veneers, tooth whitening, all-ceramic full and partial coverage restorations, porcelain-metal restorations, implants, and removable prosthetic restorations. With the increased knowledge and interest of patients in having the appearance of their teeth changed with esthetic dentistry, the more conservative technique of tooth whitening with vital bleaching has gained wider acceptance.

Tooth whitening refers to any procedure that changes the shade and appearance of teeth without using restorative materials. Tooth whitening can include professionally dispensed products and over-the-counter (OTC), patient-purchased products. To patients, tooth whitening includes whitening toothpastes, OTC bleaching products, routine dental prophylaxis, professionally dispensed vital bleaching products, non-vital tooth bleaching, and even denture cleaners. Bleaching can be used as a treatment for teeth that are discolored due to intrinsic and extrinsic staining. Examples of intrinsic staining are endodontic staining and tetracycline-induced discoloration. Extrinsic staining of the enamel includes fluorosis, yellowing due to aging, hypoplastic enamel, caries demineralization, and teeth staining due to smoking, ingested food, and beverage. Caries can be both intrinsic and extrinsic staining of tooth structure.

Professionally dispensed vital tooth bleaching refers to the materials, techniques, and devices used for vital bleaching that are dispensed in the dental office. In recent years, patients have had an increased interest in bleaching to treat discolored teeth. Bleaching, especially at-home bleaching, interests dentists and patients alike because it is the most conservative, non-invasive treatment modality currently available to the dental clinician to change the appearance of teeth. Bleaching is usually used to lighten the shade of teeth that are darkened due to intrinsic and extrinsic discolorations. These techniques can include a variety of concentrations of hydrogen and carbamide peroxide, in-office techniques with and without light or heat enhancement, professionally dispensed whitening strips, and tray bleaching. This article will review the different types of systems, indications, and contraindications for vital tooth bleaching



Figure 1 Scalloped tray for at-home bleaching.

and some of the reported adverse effects.

The first reports of tooth bleaching were as early as 1877 (1). The acceptance of tooth bleaching as a non-invasive, conservative treatment for discolored teeth has only gained increasing acceptance in the past 30 years using heated, high concentrations of hydrogen peroxide (2,3). The clinical reports show that in most cases, special heat lamps are mounted at chairside with the application of the dental dam as a barrier to protect the gingival tissues from the high concentration, heated hydrogen peroxide result in the need for multiple office visits (five to seven) and chair time (one hour per visit) to attain an acceptable tooth whitening result. Among the adverse reactions reported were: tooth hypersensitivity and soft tissue irritation due to the high concentration of hydrogen peroxide seeping under the dental dam.

A desire for less complex tooth bleaching procedures led to investigations into other types of delivery systems and chemistries to achieve vital bleaching. In 1989, a technique using an at-home mouthguard (tray) with an OTC 10% carbamide peroxide that was used for the treatment of gingivitis was described as successfully whitening teeth. (3) This initial report was followed by technique-specific carbamide peroxide gels for vital tooth whitening in mouthguards. As with any new procedure presented to the dental profession, there were concerns about the safety, efficacy, and longevity of these bleaching techniques with peroxide materials. Both the United States Food and Drug Administration and the dental profession raised these issues (4-6).

Research to answer many of the concerns expressed about professionally dispensed bleaching peroxides have addressed these concerns adequately and have demonstrated safety and effectiveness of tooth whitening with peroxide products (7-10). By 1995, a survey of 8,143 dentists reported that 91% provided vital tooth bleaching in their dental practices (11). Seventy-nine percent of these dentists reported success with tooth whitening. Among the side effects reported by the respondents were the following: 62.2% noted tooth sensitivity 10.7% of the time; 45.9% reported soft tissue irritation 5.6% of the time, 2.1% noted systemic effects 0.2% of the time, and 18.8% reported no side effects.

Vital tooth bleaching has become a well-accepted and successful procedure in dental practices. Vital bleaching using a tray is the most popular. In recent years, a number of manufacturers have introduced light-enhanced tooth bleaching products with devices to provide for this light enhancement and higher concentration peroxides for in-office use. The availability of OTC tooth whitening products to our patients has also increased significantly in the past decade.

During the early introduction of tray (mouthguard) vital

bleaching with carbamide and hydrogen peroxide bleaching agents, studies have demonstrated efficacy and safety with these agents (12–18). In all cases, the agents evaluated lightened the color of the teeth safely and effectively with minimal adverse reactions reported. In addition, when the bleaching procedure was completed, any adverse reactions that were reported during treatment were no longer present. With the increased acceptance by the dental profession of vital tooth bleaching and tooth whitening with other products, the American Dental Association (ADA) issued a report in 1994 and in 1998 revised the guidelines for safety and efficacy criteria for peroxide containing products to include their use for tooth bleaching. Any product that meets these criteria could receive the ADA Seal of Acceptance. To receive the seal, a company would have to submit safety studies and two clinical trials that demonstrate at least two value-oriented shade increments of change when the bleaching recommendations are followed (5). To date, the majority of bleaching products to obtain the seal are 10% carbamide peroxide gels used with a tray delivery.

The original concept of professional vital bleaching started with well-fitted, custom-made trays from patient impressions and casts as vehicles to hold a 10% carbamide peroxide gel. Today, the clinician has many choices for providing patients with at-home tooth bleaching materials and techniques. These include a variety of different types of tray and tray-less systems that deliver either hydrogen or carbamide peroxide in a wide range of concentrations. When comparing the chemical concentration of hydrogen peroxide to carbamide peroxide, an approximate formula ratio to use is that 3% hydrogen peroxide is approximately equivalent to 10% carbamide peroxide. In the past decade, a number of different peroxide bleaching products have been introduced for professional dispensing. There have been modifications in the chemistry to make the available peroxide longer lasting for overnight tray bleaching (19, 20). The addition of a carbopol to carbamide peroxide vital tooth bleaching gels extend the bleaching potential of the gel over as long as 8 hours (21). This allows the clinician to recommend to patients that a tray with a carbamide bleaching gel can be worn overnight. This is not true of hydrogen peroxide-based vital tooth bleaching products. Hydrogen peroxide will lose more than 50% of its bleaching potential within 30 minutes. This chemical degradation over 30 minutes is responsible for the recommendation of trayless strip technology (e.g., Crest Whitestrips), in which the strip is worn for only 30 minutes at a time. Also, most manufacturers provide a range of higher concentrations of peroxides—both carbamide peroxide and hydrogen peroxide—to decrease the wear time of the tray and/or decrease the time necessary to achieve the final whitening result. Higher concentration hydrogen peroxides (25%–35%) are used for in-office bleaching with and without light and heat enhancement.

AT-HOME TRAY BLEACHING

When professional vital tooth bleaching using trays for at-home use was first introduced to the profession, there were concerns over adverse reactions and patient complaints. The adverse reactions and patient complaints included: taste of bleaching gel, gingival irritation, uneven tooth bleaching, splotchy appearance of the teeth during the initial stages of bleaching, and tooth hypersensitivity while bleaching. These issues have been investigated and research has provided a better understanding. Manufacturers of tooth bleaching

products have made changes in technique recommendations and product components to address these issues. Clinician and patient complaints concerning issues of taste have been addressed with an expanded selection of better flavors for improved patient acceptance. Gingival irritation has occurred with trays that were poorly fabricated either because of inaccuracy of casts or the need for scalloping the tray for higher concentrations of hydrogen and carbamide peroxide bleaching gels (22). During the initial bleaching, especially with higher concentrations of tray bleaching gels, patients have reported a splotchy appearance of the teeth during the first week (22). This uneven coloration of the teeth being bleached disappears after the first week of bleaching.

Tooth sensitivity during bleaching has been the highest reported adverse reaction. In clinical research studies, tooth sensitivity during bleaching has been reported in a range of 18%–78% of patients, either with at-home tray delivery or in-office procedures (23–25). The sensitivity due to tooth bleaching in clinical observations suggests that it is transient, with no long-term effects (26). Some clinicians believed that this transient sensitivity was due to gingival recession. However, it has been shown that gingival recession is not a factor in the occurrence of tooth hypersensitivity when bleaching (27). There was no significant difference in reported sensitivity while bleaching based on the presence or absence of gingival recession. To minimize tooth sensitivity during vital tooth bleaching, the clinician can recommend that the patient decrease the time the tray is worn the first week, to no more than 1 hour a day for carbamide peroxide products or for higher concentration hydrogen peroxides, as little as 15 minutes a day or use lower concentrations of peroxide. Five Percent potassium nitrate (KNO₃) formulation has been shown to be an effective desensitizer in toothpastes (FF, use three others). Noting this effectiveness, a number of manufacturers have added a 5% KNO₃ desensitizing agents to their bleaching gels. The addition of KNO₃ to bleaching gels does not provide the sensitivity relief that is seen with KNO₃ in extended use with desensitizing toothpastes (23, 28). Two effect strategies using a KNO₃- desensitizing toothpaste that have been clinically evaluated are brushing with the desensitizing toothpaste for 2 weeks before initiating bleaching (23) and having the patient place a sensitivity toothpaste containing a 5% KNO₃ 1 week before initiating bleaching in the tray that will be used for bleaching for 30 minutes a day (29). Both strategies take into account the mechanism for desensitizing that KNO₃ provides. Another strategy is to have a patient use a professionally dispensed desensitizing gel with 5% KNO₃ for use with bleaching (30). Amorphous calcium phosphate (ACP) has been shown to be an effective desensitizer (31, 32). Recent research has shown that a paste (Prospec MI Paste, GC America) containing Recaldent®, a casein phosphopeptide- amorphous calcium phosphate (CPP-ACP), has been effective in reducing tooth sensitivity due to bleaching (29,33). One manufacturer, Discus Dental, has introduced bleaching products that contain ACP. A research study evaluating these ACP-containing bleaching gels demonstrated that ACP could be added to a 16% carbamide peroxide bleaching gel with significant reduction in clinical measures of dentinal hypersensitivity both during and after treatment (34).

Over the years, there has been controversy about what tray is best. When tray bleaching was introduced, the trays

were fabricated from thin and thick flexible vacuum-forming materials and thin rigid plastic materials. Some manufacturers created a foam-lined tray, believing it would hold the bleach on the teeth more effectively. From the current research that has evaluated a wide variety of tray configurations and types, and duration of wearing the tray, one can conclude the following:

- Thin flexible vacuum-formed materials are the standard
- Spacers on the stone model to create reservoirs is not necessary, but using reservoirs results in the patient swallowing less bleaching gel (35, 36)
- Scalloping the tray to follow the gingival contours is not necessary when using a 10% carbamide peroxide, but should be done for higher concentrations of carbamide peroxide or hydrogen peroxide equivalents. Over-trimming the tray leaving a portion of the tooth uncovered is not a problem because the bleach will penetrate beyond the tray (37)
- Custom-fitted trays provide improved bleaching gel-tooth contact (36)
- Most companies provide bleaching gel for a 2-week application
- Higher concentrations of carbamide peroxide bleach worn in a tray show faster initial improvements, but over a 6 week period comparing 10% carbamide peroxide to higher concentrations, there is no difference in the final result (38, 39)
- The concept of teeth lightening to a final certain level has been termed as the “inherent lightness potential” of a tooth; there is an endpoint to how much lighter teeth will get (39)
- In most cases, moderate and dark tetracycline staining can be treated with bleaching over an extended time of 3–6 months (40, 41)
- Concern over the effectiveness of the bleaching potential with overnight wearing of a tray has been addressed; wearing a tray overnight with a bleaching gel has demonstrated a degradation in peroxide concentration over time, but the bleaching agent is still effective. Hydrogen peroxide has a greater than 50% degradation within 30 minutes, whereas carbamide peroxide bleaching gels can be used overnight (21)



Figure 2 A. Preoperative view before at-home tray bleaching. B. Postoperative view after 6 weeks of bleaching with a 10% carbamide peroxide (TiON at-home, GC America)

- 10% at-home carbamide peroxide bleaching gels are clinically safe when exposed to enamel, dentin, root surfaces, ceramics, cast metal, and composite resins (10); there is one case report of greening of amalgam during bleaching.

At-home tray bleaching requires a number of steps to achieve success, which include accurate study casts that need to be trimmed to allow for a vacuum-down, thin, flexible mouthguard to be fabricated. The mouthguard can be trimmed to be scalloped (for the higher concentrations of bleaching peroxides) or with a 0.5–1 mm extension from the free gingival margin. The patient should be instructed on the how to place the bleaching gel in the trays and how to remove any excess gel after insertion. Although there are variations in the duration for wearing the tray, for most patients 2 weeks at least 1 hour a day will provide up to 90% of the whitening effect. Research has shown that a bleaching endpoint will be reached at 6 weeks independent of the concentration and type of peroxide used (Figure 2). Table 1 has a partial listing of at-home professionally dispensed bleaching products.

Table 1 Partial listing of at-home bleaching products for professional dispensing

| Name | Active ingredient | Manufacturer |
|----------------------------|------------------------------------|-------------------------|
| Crest Whitestrips Supreme | 14% hydrogen peroxide | Proctor and Gamble |
| Colgate Platinum Overnight | 10% carbamide peroxide | Colgate |
| Colgate Visible White | hydrogen peroxide (5%, 7%, 9%) | Colgate |
| Sapphire Home Whitening | carbamide peroxide (22%, 32%) | Den-Mat |
| Opalescence | carbamide peroxide (10%, 15%, 20%) | Ultradent |
| Très White | 9% hydrogen peroxide | Ultradent |
| TiON | 10% carbamide peroxide | GC America |
| Night White ACP | carbamide peroxide (10%, 16%, 22%) | Discus Dental |
| Day White ACP | hydrogen peroxide (7.5%, 9.5%) | Discus Dental |
| Vivastyle | carbamide peroxide (10%, 16%) | Ivoclar |
| Perfecta REV | 14% hydrogen peroxide | Premier Dental Products |
| White and Brite | carbamide peroxide (10%, 16%, 22%) | Omni |
| NuPro Gold | carbamide peroxide (10%, 16%) | Dentsply |

TRAYLESS BLEACHING: PROFESSIONALLY DISPENSED AND OTC

Patients are using OTC whitening products in greater numbers. In recent years, manufacturers have developed novel, trayless methods of bleaching teeth. The first product introduced professionally was Crest Whitestrips (Procter and Gamble) for in-office dispensing. Within a year after Whitestrips was introduced, a lower hydrogen peroxide concentration was released as an OTC product. One problem with OTC whitening products, especially bleaching products, is that there has been no diagnosis of the condition for which the patient is bleaching. One service that dentists offer in the area of esthetics is the comprehensive evaluation and diagnosis of intraoral conditions. Use of OTC products may be inappropriate. Also, a patient using a peroxide bleaching OTC product may have detrimental effects on the use of bonding agents in the placement of composite resin restorations (42–45). For patients who are being treated, if their teeth look unusually lighter in color or opalescence in appearance, it would be worthwhile to ask if they have bleached their teeth, and if so, how recent. It is recommended that the clinician, including orthodontists placing bonded brackets, wait at least 1 week post-bleaching before doing an adhesive procedure.

In the past 2 years, the concentration of the hydrogen peroxide in both professionally dispensed and OTC Whitestrips has increased. Other OTC strips have become available from other manufacturers as well. These whitening strips have been shown to be effective at tooth whitening similar to the use of at-home carbamide peroxide bleaching products with trays (46–52). Also, there is no doubt that teenagers are purchasing and using whitening strips that contain hydrogen peroxide. What is the safety and effectiveness of an adolescent using a whitening strip? According to a recent research report evaluating whitening strips used by teenagers, there was significant tooth whitening with no adverse effects (53). One of the limitations of strips is the number of teeth that can be whitened. Strips only cover the anterior teeth, from canine to canine and are difficult to apply when a patient has misaligned teeth. It is important that if a patient asks you about using whitening strips, you should evaluate the alignment of the teeth to verify that the tooth position would be acceptable for strip whitening. In response to the need for a trayless system that will both cover more teeth and not be impeded by tooth misalignment, a tray applied, thin membrane bleaching system, Trēswhite (Ultradent Products) was introduced. This novel trayless system that uses a 9% hydrogen peroxide also includes a gel barrier at the gingival margin that ensures improved comfort when being worn. This author has had a number of dental students try this system and they have reported favorably on the ease of use and we were able to document significant whitening results. The benefits of a trayless system are that: a) it needs to be worn only 30 minutes, twice a day; b) no filling of a tray before insertion, eliminating the patient putting too much or too little in; and c) the trayless strip or membrane is disposable.

OTC WHITENING—OTHER PRODUCTS

Whitening is a catchall phrase used with many OTC dental products that are not bleaching products per se, but will remove extrinsic stains from the tooth structure. Toothpastes, mouth rinses, gums, and paint-on products tout the benefits of whitening on their labels. If a patient asks

about a given oral care product and its effectiveness in whitening, there is limited research to support this cosmetic claim. In most cases, unless an active peroxide is present in the oral care product, the whitening effect is primarily stain removal. In some cases, the presence of an active peroxide may not contribute to significant whitening due to the method of application and the mode and duration of how the peroxide contacts with the teeth.

Many patients would want to believe that a “paint-on” whitener can be effective. There are a variety of products that are for patient application for painting on the teeth. Do these products work? It depends on the product and the amount of whitening you desire. Research has shown that there is a whitening effect (probably extrinsic stain removal) when Colgate Simply White (18% carbamide peroxide paint on) was compared to a whitening toothpaste (Crest Vivid White). Both products had a similar whitening effect (54). When compared to patient applied at-home trays with a low concentration of carbamide peroxide (5%), a paint-on product (18% carbamide peroxide) and a 1% hydrogen peroxide toothpaste were not as effective (55). In another study, whitening strips performed significantly better at whitening than either a paint-on bleaching product or a non-peroxide whitening toothpaste (56). Keep in mind that the whitening effects of these paint-on products (Colgate Simply White, 18% carbamide peroxide; Crest Night Effects for Sensitive Teeth, 9.7% sodium percarbonate), although not as great as whitening strips or conventional professional tooth whitening, they may be sufficient for patient satisfaction (57, 58). Also, a mouth rinse has been introduced recently that contains 2% hydrogen peroxide for whitening. Over a 6-week clinical trial, the 2% hydrogen peroxide pre-rinse showed no significant color improvement to regular tooth brushing (59). Patients are always looking for convenience in self-provided dental treatment. With this in mind, a number of “whitening gums” have been introduced. In clinical trials, these gums have been shown to reduce extrinsic tooth staining and inhibit additional tooth staining (60, 61).

IN-OFFICE, ONE-HOUR WHITENING

The first bleaching of teeth to change color was an in-office procedure. Currently, the most popular systems for in-office bleaching use high concentration hydrogen peroxides and are often referred to as “one-hour bleaching.” These high concentration hydrogen peroxides range from 25% to 35%. In-office bleaching can be provided to patients as either a one-visit 1–1.5 hour treatment or a multiple visit procedure (62–65). One can use one of the light enhanced bleaching techniques, a laser-activated bleach or merely a paint-on bleaching gel or solution. For the in-office, light-enhanced systems, usually the light can only be used for bleaching (BriteSmile, Discus Dental; LumaArch, LumiLite; Zoom 2, Discus Dental). One light system is based on a plasma arc high-intensity photopolymerization device (Sapphire PAC Light, Den-Mat) that can be used for in-office whitening and for resin photopolymerization. In-office professional whitening can be a perfect complement to the at-home whitening system you are using. There are many patients who cannot find the time to apply trays or strips in their busy lives. In-office whitening offers the convenience of whitening their teeth in one or more dental appointments. For these patients, at-home tray bleaching does not fit their busy schedules. Two visits using a 1-hour, in-office bleaching



Figure 3 Bleaching using a light-enhanced (Sapphire Lightening Crystal, Den-Mat) 35% hydrogen peroxide, in-office bleaching system.

system that was light enhanced (Figure 3; Sapphire Light with Lightening Crystal, Den-Mat) provided the patient with a desired whitening improvement for her smile (Figure 4).

How effective is in-office bleaching? Studies have compared in-office bleaching to at-home tray bleaching (66, 67). At-home, tray bleaching usually gives the best final result. The results of in-office bleaching with light enhancements have been controversial. Within the dental literature, there are conflicting studies on whether or not high concentration hydrogen peroxide bleaching compounds are effective (68, 69). Some studies have shown that light-activated/enhanced bleaching products provide better whitening (62, 63, 70); whereas other studies demonstrate that there is no benefit to using an accessory light (71–73). There are a variety of 1-hour whitening systems and products available. The techniques for 1-hour whitening vary from product to product. In most cases, the in-office vital tooth bleaching products are 25%–35% hydrogen peroxide gels. The use of high concentration hydrogen peroxide gels intraorally requires specific safety protocols. First, the doctor and patient must be wearing eye protection, and the gingival soft tissues adjacent to the procedure must have a barrier placed (Figure 5). Some lights generate heat and or UV rays, so a rubber dam napkin can be used to shield the face from the light source. In some cases, the manufacturers provide moisturizers for the lips or sun screen as protection from the UV rays. Although a dental dam would be ideal, as was seen with earlier bleaching techniques, the placement of a dental dam will inhibit the bleaching of the cervical areas of the teeth, which will dissatisfy patients. Naturally, patients want their entire visible tooth surface to get whiter. The manufacturers have responded by providing barrier protection in the form of a light-cured resin (similar to



Figure 4 A. Preoperative view before in-office, light-enhanced bleaching. B. Postoperative after two visits of in-office, one-hour whitening (Sapphire Professional Whitening, Den-Mat)



Figure 5 Barrier placed with light cured resin to protect gingival tissues during high concentration hydrogen peroxide in-office bleaching.

flowable composite resin) that is painted over the gingival tissues. See Table 2 for a partial listing of 1-hour bleaching systems.

Concerns have been expressed that: a) 1-hour whitening with light enhancement is not different from whitening without the light, b) multiple visits are needed, c) 1-week, at-home tray whitening is recommended after the in-office procedure, and d) that there is sensitivity during this chairside procedure (64, 66, 67, 74, 75). If this is the case, why use a light? The use of a light to enhance vital tooth bleaching is important in the dental practice because the patient expects to see the light. Our patients do not live in closets with no contact with the outside world. Our patients have seen articles in the newspapers and magazines and

Table 2 Partial listing of one-hour whitening products (and devices if available)

| | | | |
|---------------------------------|------------------------|--|---------------|
| Sapphire Professional Whitening | 35% hydrogen peroxide | (Sapphire PAC curing light with Whitening Crystal) | Den-Mat |
| TiON | 25% hydrogen peroxide | (any light for activation) | GC America |
| Zoom 2 | 25% hydrogen peroxide | (Zoom 2 bleaching light) | Discus Dental |
| White Speed | 35% carbamide peroxide | | Discus Dental |
| Opalescence Xtra Boost | 38% hydrogen peroxide | | Ultradent |
| Opalescence Quick | 35% carbamide peroxide | | Ultradent |
| LumaArch | 35% hydrogen peroxide | | LumiBrite |
| Illuminé | 35% hydrogen peroxide | | Dentsply |
| BriteSmile | 36 % hydrogen peroxide | | Discus Dental |



Figure 6 A. Preoperative view, diagnosis tetracycline induced tooth discoloration. B. Postoperative view, tooth whitening after 6 months of at-home tray whitening with a 10% carbamide peroxide system (Opalescence, Ultradent)

watched the extreme makeover television shows where the light is being used. Even though the research is not definitive on the use of light-enhanced bleaching, the patient expects its use. Without using the light, patients will wonder if they are getting the proper care. There is no harm to using the light and many look upon light-enhanced bleaching as important for patient satisfaction and marketing.

PATIENT SELECTION FOR VITAL TOOTH BLEACHING

When treatment planning for successful esthetic treatment for tooth discolorations it is important to select patients with conditions that have the best prognosis for success with bleaching. Key factors that have an affect on the final result after bleaching include concentration of the bleaching agent, duration of use of the bleaching agent, type of tooth discoloration, color of the teeth, and patient's age (8). It has been reported that tooth discolorations with the best prognosis for whitening are

1. yellowing of the teeth without any systemic or developmental cause (food, smoking, aging, staining)
2. mild flourosis staining
3. mild tooth darkening due to trauma
4. mild tetracycline staining (16, 17)

It has been reported that moderate to severe tetracycline discoloration can be lightened in shade with overnight use of a vital mouthguard bleaching over a period of 6 months. (Figure 6) (40, 41).

Many dentists are using vital tooth bleaching as an adjunct to their esthetic bonding procedures. For patients dissatisfied with tooth malposition and shape combined with discolorations, lightening the shade of teeth first with bleaching makes masking tooth discolorations less difficult. It is important that before any bonding procedure that bleaching be discontinued for at least one week before the restorative treatment to prevent interference with bonding adhesion and material setting (77–80).

BLEACHING RELAPSE

From all clinical and research accounts, tooth whitening with the latest generation of vital bleaching products is effective and safe (12–18, 20, 62, 63, 71, 72, 81, 82) also relatively long lasting. Bleaching relapse has been reported. With in-office bleaching, CRA reported relapse of 41% at 1 year (72). For tray bleaching, Haywood reports 26% at 18 months (83). Others have reported varying degrees of bleaching relapse over time (84–86). To prevent bleaching relapse, a patient would have better success with a power toothbrush with a whitening toothpaste over manual toothbrushing (84). Bleaching can be maintained through the use of whitening toothpastes and bleaching toothpastes with yearly touch-up bleaching using a peroxide bleaching agent in the patient's custom fitted tray.

Maintaining whitened teeth—minimizing bleaching relapse

- Use a whitening toothpaste to remove surface stains and prevent yellowing with a power toothbrush
- Brush or rinse immediately after consuming stain-causing beverages or foods
- Use a straw to drink beverages that stain, such as coffee, tea, colas, and red wine
- For woman wear a bright shade of lipstick-blue or pink based. It will make your teeth appear whiter. Avoid orange or brown shades
- Check whether you need a touch up. Depending on the whitening method you used, you may need a touch up in 6 months or after a year or two. If you smoke or drink a lot of coffee, you may need a touch up more often

CONCLUSION

Vital tooth bleaching is an effective treatment modality that can significantly change the appearance of teeth. Patient satisfaction has been demonstrated after use of both professionally dispensed bleaching treatments and OTC products. Based on the clinical results reported with professional vital tooth bleaching, it is a viable, esthetic treatment for the discolored dentition (87). Its conservative nature and little, if any, risk makes it an important part of an esthetic dentistry treatment plan.

REFERENCES

1. Feinman RA, Goldstein RE, Garber DA. Bleaching teeth. Chicago: Quintessence Books, p. 10, 1987.
2. Cohen S, Parkins FM. Bleaching tetracycline-stained vital teeth. *Oral Surg* 29:465–471, 1970.
3. Haywood VB, Heymann HO. Nightguard vital bleaching. *Quintessence Int* 20:173–176, 1989.
4. Berry J. FDA says whiteners are drugs. *ADA News*, 22(18): 1, 6, 7; 1991.
5. American Dental Association, Council on Scientific Affairs. Acceptance program guidelines for home-use tooth whitening products. Chicago: American Dental Association, 1998.
6. Haywood VB. The Food and Drug Administration and its influence on home bleaching. *Curr Opin Cosmetic Dent*: p. 12–18; 1993.

7. Burrell KH. ADA supports vital tooth bleaching—but look for the seal. *J Am Dent Assoc* 128:35–55, 1997.
8. Haywood VB. Nightguard vital bleaching: Current concepts and research. *J Am Dent Assoc* 128:195–255, 1997.
9. Li Y. Toxicological considerations of tooth bleaching using peroxide containing agents. *J Am Dent Assoc* 128:315–365, 1997.
10. Haywood VB, Heymann HO. Nightguard vital bleaching: How safe is it? *Quintessence Int*, 22:515–523, 1991.
11. Christensen GJ, Christensen RP. Home use bleaching survey—1995. *CRA Newsletter* 19(10):1, 1995.
12. Howard WR. Patient applied tooth whiteners. *J Am Dent Assoc* 123:57–60, 1992.
13. Gegauff AG, Rosenstiel SF, Langhout KJ, Johnson WM. Evaluating tooth color change from carbamide peroxide gel. *J Am Dent Assoc*, 124:65–72, 1993.
14. Rosenstiel SF, Gegauff AG, Johnston WM. Randomized clinical trial of efficacy and safety of a home bleaching procedure. *Quintessence Int* 27:383–388, 1996.
15. Godder B, Kaim JM, et al. Evaluation of two at-home bleaching systems. *J of Clin Dent* 5:86–88, 1994.
16. Reinhart JW, Eivins SE, et al. A clinical study of nightguard vital bleaching. *Quintessence Int* 24:379–384, 1993.
17. Russell CM, Dickinson GL, et al. Dentist supervised home bleaching with ten percent carbamide peroxide gel: A six month study. *J Esthet Dent* 8:177–182, 1996.
18. Haywood VB, Leonard RH, et al. Effectiveness, side effects and long-term status of nightguard vital bleaching. *J Am Dent Assoc* 125: 1219–1226, 1994.
19. Fasanaro TS. Bleaching teeth: History, chemicals and methods used for common tooth discolorations. *J of Esthet Dent* 4:71–78, 1992.
20. Haywood V. Nightguard vital bleaching: Current information and research. *Esthet Dent Update* 1(2):20–23, 1990.
21. Matis BA, Gaiao U, Blackman D, et al. In vivo degradation of bleaching gel used in whitening teeth. *J Am Dent Assoc*. 130:227–235, 1999.
22. Strassler HE, Symer SE, Hendrix J. Update of vital tooth bleaching. *California Dental Institute for Continuing Education*; 63:11–23. 1997.
23. Haywood VB, Cordero R, Wright K, Gendreau L, Rupp R, Kotler M, Littlejohn S, Fabyanski J, Smith S. Brushing with a potassium nitrate dentifrice to reduce bleaching sensitivity. *J Clin Dent* 16:17–22, 2005.
24. Tredwin CJ, Naik S, Lewis NJ, Scully C. Hydrogen peroxide tooth whitening (bleaching) products: Review of adverse effects and safety issues. *Br Dent J* 200:371–376, 2006.
25. Jorgensen MG, Carroll WB. Incidence of tooth sensitivity after home whitening treatment. *J Am Dent Assoc* 133:1076–1082, 2002.
26. Swift EJ Jr. At-home bleaching: Pulpal effects and tooth sensitivity issues, part ii. *J Esthet Restor Dent* 18:301–304, 2006.
27. Gerlach RW, Barker ML, Anastasia MK, Bsoul S, Terezhalm GT. Gingival recession and clinical response with extended whitening strip use. *J Dent Res* 84 (Special Issue A): Abstract no. 2124, 2005.
28. Blalock J, Callan RS, Brackett MG, Frazier K, Browning WD. Clinical evaluation of sensitivity of 10% carbamide peroxide tooth-whitening gels. *J Dent Res* 85 (Special Issue A): Abstract no. 1382, 2006.
29. Strassler HE. Tooth whitening- now and in the future: Part 2. *Contemp Esthet Restor Pract*. 8(9):50–55, 2004.
30. Leonard, Jr. RH, Smith LR, Garland GE, Caplan DJ. Desensitizing agent efficacy during whitening in an at-risk population. *J Esthet Restor Dent* 16:49–56, 2004.
31. Tung MS, Eichmiller FC. Dental applications of amorphous calcium phosphates. *J Clin Dent*. 10(1 Spec no):1–6. 1999.
32. Yates R, Owens J, Jackson R, Newcombe RG, Addy M. A split-mouth placebo-controlled study to determine the effect of amorphous calcium phosphate in the treatment of dentine hypersensitivity. *J Clin Periodontol* 25:687–692, 1998.
33. Dunn J, Wilson AC, Arambula M, et al. Effects of TiON gel applications on in-office tooth whitening. *J Dent Res* 85 (Special Issue A): Abstract no. 1369, 2006.
34. Giniger M, MacDonald J, Siemba S, Felix H. The clinical performance of professionally dispensed bleaching gel with added amorphous calcium phosphate. *J Amer Dent Assoc* 136:383–392, 2005.
35. Matis BA, Hamdan YS, Cochran MA, Eckert GJ. A clinical evaluation of a bleaching agent used with and without reservoirs. *Oper Dent* 27:5–11, 2002.
36. Haywood VB. Nightguard vital bleaching; current concepts and research. *J Am Dent Assoc*. 128:215–255, 1997.
37. Oliver TL, Haywood VB. Efficacy of nightguard vital bleaching technique beyond the borders of a shortened tray. *J Esthet Dent* 11:95–102, 1999.
38. Leonard RH, Sharma A, Haywood VB. Use of different concentrations of carbamide peroxide for bleaching teeth: an in vitro study. *Quintessence Int* 29:503–507, 1998.
39. Matis BA, Mousa HN, Cochran MA, Eckert GJ. Clinical evaluation of bleaching agents of different concentrations. *Quintessence Int* 31:303–310, 2000.
40. Leonard RH, Haywood VB, Eagle JC, Garland GE, et al. Nightguard vital bleaching of tetracycline-stained teeth: 54 months post treatment. *J Esthet Dent* 11:265–277, 1999.
41. Matis BA, Wang Y, Jiang T, Eckert GJ. Extended at-home bleaching of tetracycline-stained teeth with different concentrations of carbamide peroxide. *Quintessence Int* 33:645–655, 2002.
42. Kum KY, Lim KR, Lee CY, Park KH, Safavi KE, Fouad AF, Sangberg LS. Effects of removing residual peroxide and other oxygen radicals on the shear bond strength and failure modes at resin tooth interface after tooth bleaching. *Am J Dent*. 17:267–70, 2004.
43. Titley KC, Torneck CD, Ruse ND, Krmec D. Adhesion of resin composite to bleached and unbleached human enamel. *J Endod* 19:112–115, 1993.
44. Kanematsu A, Yamamoto T, Tanaka H, Muraguchi K, Kurashege, Tanaka T, Suzuki S. Tensile bond strength of self-etching adhesives to bleached enamel. *J Dent Res* 85 (Special Issue A): Abstract no. 1331, 2006.
45. Kao EC, Mujllins JM, Ngan P, Martin CA. Effects of tooth whitening on clinical survival of orthodontic brackets. *J Dent Res* 85 (Special Issue A): Abstract no. 782, 2006.
46. Matis BA, Gaiao U, Blackman D et al. In vivo degradation of bleaching gel used in whitening teeth. *J Am Dent Assoc*. 130:227–235, 1999.
47. Barker ML, Baker RA, Shahidi H, Sagel PA, Gerlach RW. 10% hydrogen peroxide whitening strips: Evidence from 8 clinical trials. *J Dent Res* 84 (Special Issue A): Abstract no. 1811, 2005.
48. Lawson JLK, Cobb DS, Vargas MA, Levy SM, Broffitt B. Evaluating tooth color change comparing over-the-counter and professional strength whitestrips. *J Dent Res* 85 (Special Issue A): Abstract no. 1943, 2006.
49. Magnusson I, Karpinia K, Benz L, Farrell S, Barker ML, Gerlach RW. Clinical trial comparing tab and strip tooth

- whitening systems. *J Dent Res* 85 (Special Issue A): Abstract no. 1377, 2006.
50. Garcia-Godoy F, Villalta P, Garcia-Godoy C, Bowman LA, Barker ML, Gerlach RW. Clinical evaluation of 14% hydrogen peroxide strips relative to placebo. *J Dent Res* 85 (Special Issue A): Abstract no. 1372, 2006.
 51. Magnusson I, Karpinia K, Harris P, Anastasia MK, Barker ML, Gerlach RW. 18-month post-treatment safety and efficacy of 10% hydrogen peroxide strips. *J Dent Res* 85 (Special Issue A): Abstract no. 1371, 2006.
 52. Garcia-Godoy F, Villalta P, Tucker HL, Barker ML, Gerlach RW. Clinical trial comparing two direct-to-consumer tooth whitening systems. *J Dent Res* 85 (Special Issue A): Abstract no. 1374, 2006.
 53. Donly KJ, Henson T, Jamison D, Gerlach RW. Clinical trial evaluating two peroxide whitening strips used by teenagers. *Gen Dent* 54:110–112, 2006.
 54. Gerlach RW, Dunavent JM, Gibb RD, Weller AD, Martinez CE. Clinical whitening of dentifrice and paint-on gel versus tray control. *J Dent Res* 84 (Special Issue A): Abstract no. 290, 2005.
 55. Gerlach RW, Barker ML, Tucker HL. Clinical response of three whitening products having different peroxide delivery: Comparison of tray, paint-on gel, and dentifrice. *J Clin Dent* 15:112–117, 2004.
 56. Gerlach RW, Barker ML. Clinical response of three direct-to-consumer whitening products: Strips, paint-on gel, and dentifrice. *Compend Contin Educ Dent* 24:458–466, 2003.
 57. Gerlach RW, Barker ML, Date RF, Prendergast MJ, Liebman J, Mallat P. Placebo-controlled clinical trial evaluating brush-applied overnight peroxide whitening. *J Dent Res* 85 (Special Issue A): Abstract no. 1379, 2006.
 58. Farber K, Browning WD, Chan DCN, Brackett WW. Tooth whitening: A survey of patient expectations. *J Dent Res* 85 (Special Issue A): Abstract no. 1648, 2006.
 59. Gerlach RW, Barker ML, Tucker HL, Witt JJ, Ellingson KH, Wong AL. Six-week clinical trial of a 2% hydrogen peroxide pre-rinse. *J Dent Res* 85 (Special Issue A): Abstract no. 1380, 2006.
 60. Porciani PF, Grandini S, Perra C, Grandini R. Whitening effect by stain inhibition from a chewing gum with sodium hexametaphosphate in a controlled twelve-week single-blind trial. *J Clin Dent* 17:14–6, 2006.
 61. Biesbrock AR, Walters P, Bartizek RD. A chewing gum containing 7.5% sodium hexametaphosphate inhibits stain deposition compared to a placebo gum. *Compend Contin Educ Dent* 25:253–258, 2004.
 62. Li Y, et al. Effect of Light Application on an In-Office Bleaching Gel. *J Dent Res* 82 (Special Issue, AADR Abstracts): No. 895, 2003.
 63. Luk K, Tam L, Hubert M. Effect of light energy on peroxide tooth bleaching. *J Am Dent Assoc* 135(2):194–201, 2004.
 64. de Silva Gottardi M, Brackett MG, Haywood VB. Number of in-office light activated bleaching treatments needed to achieve patient satisfaction. *Quintessence Int* 37:115–120, 2006.
 65. Tavares M, Stultz J, Newman M, Smith V, Kent R, Carpino E, Goodson JM. Light augments tooth whitening with peroxide. *J Am Dent Assoc* 134:167–175, 2003.
 66. Dietshi D, Rossier S, Krejci I. In vitro colorimetric evaluation of the efficacy of various bleaching methods and products. *Quintessence Int* 37:515–526, 2006.
 67. Zekonis R, Matix BA, Cochran MA, Al Shetri SE, Eckert GJ, Carlson TJ. Clinical evaluation of in-office and at-home bleaching. *Oper Dent* 28:114–121, 2003.
 68. Buchalla W, Attin T. External bleaching therapy with activation by heat, light, or laser—A systematic review. *Dent Mater* 30: epub ahead of print, 2006.
 69. Joiner A. The bleaching of teeth: a review of the literature. *J Dent* 34:412–419, 2006.
 70. Li Y, Lee SS, Zheng M, Forde CA, Carino CM. Effect of light treatment on in vitro tooth bleaching efficacy. *J Dent Res* 85 (Special Issue A): Abstract no. 275, 2006.
 71. Papathanasiou A, Kastali S, Perry RD, Kugel G. Clinical evaluation of a 35% hydrogen peroxide in-office whitening system. *Comp Cont Dent Educ* 23:335–346, 2002.
 72. Clinical Research Associates. In-office vital tooth bleaching an update, 28(6):1–2, 2004
 73. Sulieman M, MacDonald E, Rees JS, Addy M. Comparison of three in-office bleaching systems based on 35% hydrogen peroxide with different light activators. *Am J Dent* 18:194–197, 2005.
 74. Kugel G, Papathanasiou A, William III AJ, Anderson C, Ferreira S. Clinical evaluation of chemical and light-activated tooth whitening systems. *Compend Contin Educ Dent* 27:54–62, 2006.
 75. Kugel G, Ferreira S, Sharma S, Barker ML, Gerlach RW. Clinical trial assessing light enhancement of in-office tooth whitening. *J Dent Res* 84 (Special Issue A): Abstract no. 287, 2005.
 76. Haywood VB, Heymann HO. Response of normal and tetracycline-stained teeth with pulp size variation to nightguard vital bleaching. *J Esthet Dent* 6:109–114, 1994.
 77. Godwin JM, Barghi N, Berry TG, et al. Time duration for dissipation of bleaching effects before enamel bonding. *J Dent Res*; 71:179 (Abstr 590), 1992.
 78. Cvitko E, Denehy GE, Swift Jr EJ, et al. Bond strength of composite resin to enamel bleached with carbamide peroxide. *J Esthet Dent* 1991; 3:100–102.
 79. Machida S, Anderson MH, Bales DJ. Effect of a home bleaching agent on adhesion to enamel. *J Dent Res*; 71:282 (Abstr. 1408), 1992.
 80. Basting RT, Rodrigues JA, Serra MC, Pimenta LAF. Shear bond strength of enamel treated with seven carbamide peroxide bleaching agents. *J Esthet Restor Dent* 16:250–260, 2004.
 81. Hunsaker KJ, Christensen GJ, Christensen RP. Tooth bleaching chemicals. Influence on teeth and restorations. *J Dent Res*; 69; 303 (Abstr. 1558), 1990.
 82. Haywood VB, Houck VM, Heymann HO. Nightguard vital bleaching: effects of various solutions on enamel surface texture and color. *Quintessence Int*; 22:775–782, 1991.
 83. Haywood VB. Achieving, maintaining and recovering successful tooth bleaching. *J Esthet Dent* 8:31–38, 1996.
 84. Kugel G, Aboushala A, Sharma S, Ferreira S, Anderson C. Maintenance of whitening with a power toothbrush after bleaching treatment. *Compend Contin Educ Dent* 25:119–131, 2004.
 85. Leonard Jr RH. Efficacy, longevity, side effects and patient perceptions of nightguard vital bleaching. *Compend Contin Educ Dent* 19:766–774, 1998.
 86. Haywood VB. Current status of nightguard vital bleaching. *Compend Contin Educ Dent Suppl* 21:S10–17, 2000.
 87. Ritter AV, Leonard RH Jr, St Georges AJ, Caplan DJ, Haywood VB. Safety and stability of nightguard vital bleaching: 9–12 years post-treatment. *J Esthet Restor Dent* 14:275–285, 2002.

CE Questions

Vital tooth bleaching: An update

1. Professionally dispensed vital tooth bleaching refers to
 - A. materials used for bleaching that can be bought in the oral care products of the pharmacy.
 - B. materials used for bleaching that can be purchased over the internet at special web sites.
 - C. any bleaching service that can be purchased in drive-in centers.
 - D. materials used for vital bleaching that are given to the patient after an evaluation and diagnosis in the dental office.
2. According to this article, tooth whitening refers to any procedure that
 - A. placing porcelain veneers
 - B. placing composite resin restorations
 - C. changes the shade and appearance of teeth without restorative materials.
 - D. adhesive bonded restorations that change a tooth's appearance.
3. The most conservative treatment for tooth discoloration is
 - A. porcelain veneers.
 - B. bleaching.
 - C. composite resin veneering.
 - D. ceramic crowns.
4. Bleaching is a technique to lighten the color of teeth darkened by
 - A. intrinsic staining.
 - B. extrinsic staining.
 - C. entopic staining.
 - D. a and b.
5. All the following are examples of tooth discolorations due to intrinsic staining EXCEPT. The EXCEPTION is
 - A. tetracycline induced staining.
 - B. endodontic staining.
 - C. enamel hypoplasia.
 - D. caries
6. Tooth bleaching was reported as early as
 - A. 1877.
 - B. 1905.
 - C. 1935.
 - D. 1973.
7. Early bleaching techniques used heated, high concentrations of hydrogen peroxide. Clinical problems and adverse reactions with this technique included
 1. multiple office visits (5 to 7)
 2. allergic reactions
 3. soft tissue irritation due to the high concentration of bleach
 4. tooth hypersensitivity
 5. caries formation
 - A. 2, 4, and 5
 - B. 1, 3, and 4
 - C. 2, 3, and 5
 - D. 1, 2, 4, and 5
 - E. 1, 2, 3, 4, and 5
8. With vital tooth bleaching adverse reactions were reported by patients. The highest reported adverse reaction during tooth whitening with bleaching is
 - A. gingival irritation.
 - B. tooth sensitivity during bleaching.
 - C. trays are difficult to insert.
 - D. bad taste of bleach.
9. Vital tooth bleaching using a tray and a low concentration peroxide was first described in the dental literature in what year?
 - A. 1877
 - B. 1935
 - C. 1989
 - D. 1995
10. The clinician has a number of choices for providing patients with tooth bleaching. Professionally dispensed products for tooth whitening include all the following EXCEPT one. The EXCEPTION is
 - A. mouthguard (tray) vital bleaching.
 - B. Mouthrinse.
 - C. in-office bleaching.
 - D. strips for bleaching.
11. The American Dental Association has guidelines for vital tooth bleaching and whitening products. To receive the American Dental Association seal of acceptance for a whitening product a manufacturer must submit
 - A. two clinical trials demonstrating at least 2 value-oriented shade increments of change.
 - B. safety studies.
 - C. a and b.
 - D. none of the above.
12. Trays fabricated from thin, flexible vinyl materials are the standard for vital tooth bleaching. Scalloping of trays should be done
 - A. to provide the patient with a special effect of the tray.
 - B. is not necessary when bleaching irregardless of concentration.
 - C. in-office light enhanced bleaching.
 - D. for at-home tray bleaching with higher concentrations of carbamide peroxide and hydrogen peroxide gels.
13. A number of trayless systems for professional dispensing have been introduced. One of the most popular are whitestrips. Drawbacks to bleaching with whitestrips are that they
 - A. are difficult to apply when there is anterior tooth misalignment.
 - B. don't work as effectively as tray vital bleaching.
 - C. only can whiten the six anterior teeth in maxillary and mandibular arches.
 - D. a and b.
 - E. a and c.

CE Questions

Vital tooth bleaching: An update

14. In-office bleaching typically use as the bleaching agent a
- calcium peroxide.
 - hydrogen peroxide.
 - sodium perborate.
 - sodium hypochlorite
15. Tooth hypersensitivity is an adverse reaction reported by patients doing tray, vital tooth bleaching. Tooth hypersensitivity will
- increase and continue while bleaching.
 - can cause the need for endodontic treatment.
 - is transient and is no longer present when the treatment is completed.
 - is directly related to gingival recession.
16. To minimize tooth sensitivity during vital tooth bleaching for patients having sensitivity a clinician can recommend that the patient
- decrease time the tray is worn the first week.
 - use lower concentrations of peroxide bleaching gels with a desensitizing agent.
 - use a desensitizing toothpaste before starting the bleaching in the tray for 30 minutes a day a week before starting bleaching.
 - use a professionally dispensed desensitizing gel for use with bleaching.
 - all the above can be used to minimize tooth sensitivity.
17. In-office bleaching
- must be done with a light source.
 - must be done without a light source.
 - uses hydrogen peroxides in the 6-10% range.
 - with or without a light source can give a whitening result.
18. Patients with a diagnosis for the best prognosis with vital bleaching include all the following EXCEPT one. The EXCEPTION is
- Yellowing of the teeth with a systemic or developmental cause.
 - Mild tetracycline staining.
 - Mild flourosis staining
 - Discolored porcelain.
19. In some clinical studies with patients with moderate to severe tetracycline staining vital tooth bleaching has been
- Ineffective.
 - has had a shade change when used over long periods, e.g., 6 months.
 - must use a combined in-office and tray bleaching technique.
 - should never be discussed with a patient.
20. Bleaching relapse has been reported in the literature. According to the references in this article, there can be an expectation of relapse
- 15% with one-hour whitening at one year; 8% with at-home whitening at 18 months.
 - 23% with one-hour whitening at one year; 12% with at-home whitening at 18 months.
 - 41% with one-hour whitening at one year; 26% with at-home whitening at 18 months.
 - 55% with one-hour whitening at one year; 43% with at-home whitening at 18 months.

PACE-approved course.

Instructions

- Use a pen or pencil to complete the answer sheet
- Mark one answer only for each question
- Complete Section A, B, and C (on back of this sheet)

- | | | | | | |
|-----|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| 1. | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | <input type="radio"/> E |
| 2. | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | <input type="radio"/> E |
| 3. | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | <input type="radio"/> E |
| 4. | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | <input type="radio"/> E |
| 5. | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | <input type="radio"/> E |
| 6. | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | <input type="radio"/> E |
| 7. | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | <input type="radio"/> E |
| 8. | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | <input type="radio"/> E |
| 9. | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | <input type="radio"/> E |
| 10. | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | <input type="radio"/> E |
| 11. | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | <input type="radio"/> E |
| 12. | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | <input type="radio"/> E |
| 13. | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | <input type="radio"/> E |
| 14. | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | <input type="radio"/> E |
| 15. | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | <input type="radio"/> E |
| 16. | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | <input type="radio"/> E |
| 17. | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | <input type="radio"/> E |
| 18. | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | <input type="radio"/> E |
| 19. | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | <input type="radio"/> E |
| 20. | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | <input type="radio"/> E |

Educational Disclaimer

The information presented here is for educational purposes only. It may not be possible to present all information required to use or apply this knowledge to practice. It is, therefore, recommended that additional knowledge be sought before attempting a new procedure or incorporating a new technique or therapy. The opinions of efficacy or the perceived value of any products or companies mentioned in this course and expressed herein are those of the author(s) of the course.

A. Personal Information

Name: _____

Title: _____ Specialty: _____

Address: _____ E-mail: _____

City: _____ State: _____ ZIP: _____

Telephone: (h) _____ (w) _____ (cell) _____

B. Course Evaluation

Using the statements below, please evaluate this course. (5=Excellent, 0=Poor)

- | | |
|---|---|
| <p>1. Rate the objectives and educational methods. 5 4 3 2 1 0</p> <p>2. Were the course objectives accomplished? 5 4 3 2 1 0</p> <p>3. Rate the course content. 5 4 3 2 1 0</p> <p>7. Please list any unclear or ambiguous questions (by number) you encountered.</p> | <p>4. Was the administration of the course effective? 5 4 3 2 1 0</p> <p>5. Please rate the author's grasp of the topic. 5 4 3 2 1 0</p> <p>6. Were the references adequate? Yes <input type="radio"/> No <input type="radio"/></p> |
|---|---|

8. Describe any subject matter you found confusing.

9. Would you participate in a future CE offering by this institution?
Yes No

10. What additional CE topics would you like to see in the future?

C. Payment

Payment of \$50 enclosed. Make checks payable to

MasterCard Visa AmEx Discover

Acct#: _____

Exp. Date: _____

Signature: _____

Print name as it appears on card:

Mail this form, along with payment, to:
Office of Continuing Education
Room 6310
650 W. Baltimore St.
University of Maryland Dental School
Baltimore, MD 21201

Author Disclaimer

The author of this course has no commercial ties with sponsors.

Instructions

All questions should have only one answer. Grading is done manually. Participants will receive verification by mail in 3-4 weeks after taking the exam.

Course Credits/Cost

Participants who score 70% or better (14 or more correct answers) will receive verification of CEUs accredited. This 4-hour CE course is presented by the University of Maryland Dental School, which is a member of the PACE accreditation program

Participant Feedback

Comments and questions may be e-mailed to BCDSCE@umaryland.edu.