7 IN-OFFICE POWER BLEACHING

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Power bleaching or *professional in-office bleaching* is a term used to describe the treatment of discolored dentition with high-concentration oxidizing agents by the dentist chairside. Different techniques, devices, and material choices have been used in dentistry for treating discoloration with varying success. Some situations are better suited for extended treatment outside the dental office with lower concentrations of peroxide delivered in custom trays, whereas the appearance of a severely discolored nonvital tooth may best be treated using a classic "walking bleach" technique. The primary focus of this chapter will be on the power bleaching technique used to achieve more immediate results on *multiple* vital teeth, with special consideration given to treatment of the *single* vital tooth and when combined techniques may be employed.

HISTORICAL BACKGROUND

In 1864, Dr. James Truman of the Pennsylvania College of Dental Surgery published *Discolored and Necrosed Teeth,* in which he described the technique for bleaching nonvital teeth. He is credited with the first successful method for bleaching teeth. His method included treating the patient every day for 1 to 4 weeks with chloride of lime combined with a weak acetic acid (Truman 1864). Techniques were refined throughout the decades using direct or indirect heat in attempts to accelerate the oxidation process (Harlan 1884, Nutting and Poe 1963, Cohen 1968, Chandra and Chawla 1974, Hanosh and Hanosh 1992). Direct heat techniques eventually became less prevalent because of the risk associated with cervical resorption. Chemical techniques using sodium perborate and/or superoxyl in the absence of heat continued with some success on nonvital teeth, but efficient techniques for multiple vital teeth were still lacking. Improvement in bleaching products in the mid-1990s including photosensitive formulas, and delivery systems such as light-cured barrier materials, increased use of in-office bleaching for multiple vital teeth (Barghi 1998). Combined with the introduction of at-home bleaching trays using carbamide peroxide, bleaching emerged as one of the most sought-after procedures in dentistry (Haywood and Heymann 1989).

TREATMENT PLANNING

Clinical and radiographic examination

As with all dental bleaching, a comprehensive oral examination should be performed before power bleaching. A thorough clinical and radiographic examination of the hard and soft tissues should rule out the presence of any oral pathology or dental disease and determine the cause of the stain. The clinician should make special note of any existing dental restorations, formulating a plan with the patient to replace any restorations because of postbleaching color mismatch (see Figure 7.1), and note with the patient any clinical white spot lesions that may appear accentuated immediately after bleaching (see Figure 7.2). A history of tooth sensitivity should be discussed by asking the patient if the teeth are generally sensitive to thermal changes such as when drinking hot or cold beverages.

Case selection for in-office technique

During the treatment planning process, observing the character and depth of discoloration can help discriminate whether the patient is a suitable candidate for in-office power bleaching.

Class I: Good candidate for in-office bleaching
Mild to moderate extrinsic stain (standard patient)
These are the standard patients with all forms of mild to moderate extrinsic staining. Superficial yellow to light-brown discolorations are typically from external sources such as dietary chromogens (tea, wine, coffee), poor dental hygiene, tobacco use, or staining mouth rinse (chlorhexidine); combined with aging, all of these can contribute to extrinsic staining (see Figures 7.3A and 7.3B).

Class II: Moderate candidate for in-office bleaching
Severe extrinsic to mild intrinsic stain
When the cause of the discoloration is intrinsic in nature, including hemorrhagic sources resulting from trauma, the outcome becomes less predictable. Vital teeth with mild intrinsic discoloration may respond well to in-office power bleaching after one appointment if the pulp chambers are not calcified (see Figures 7.4A–D). If the tooth is nonvital and pulpless, then it can be bleached both internally and externally simultaneously, improving the chances for a good outcome as compared with a vital tooth with no access to the pulp chamber (see Figure 7.5A–F). Although the procedure can be successful after one treatment, the patient's expectations should be prepared for the possibility of multiple treatments for severe extrinsic to mild intrinsic stains, especially if a calcified pulp chamber is observed on the radiograph.

Class III: Poor candidate for in-office bleaching

Moderate to severe intrinsic stain

Teeth that may not be suitable for in-office power bleaching include those with moderate to severe intrinsic discoloration. The single nonvital tooth with severe intrinsic stain typically will require multiple treatments such as with the "walking bleach" technique. Improved bleaching can still be expected for the severely discolored tooth; however, patients must be motivated to continue with weekly appointments for multiple sessions. In some cases the patient may tire of repeated office visits and elect to discontinue treatment before reaching maximum expected outcome (see Figures 7.6A–E).

Dense vital tooth

A single vital tooth that has a calcified or reduced pulp chamber may not respond well to in-office bleaching. When a calcified pulp chamber is noted on the radiograph, the presumption is an increased tooth density in which the peroxide will not readily diffuse. In this case, long-term at-home bleaching may improve the color, but the patient ultimately should be prepared for restorative coverage with a laminate veneer if bleaching is unsuccessful (see Figures 7.7A–D).

Setting expectations

As part of the initial patient interview, the advantages and disadvantages of in-office professional bleaching should be discussed relative to at-home bleaching and expected outcomes. The relatively higher cost and increased risk of sensitivity will be important disadvantages to note. By far the most appealing advantage for most is the prospect of "instant" results. The total time savings is material and tooth dependent. Clinical studies have shown that 7 days of at-home bleaching with 10% carbamide peroxide equals 45 minutes with 38% hydrogen peroxide (Auschill et al. 2005), or a 1-hour treatment with 28% hydrogen peroxide using supplemental light (da Costa et al. 2010). Patients should understand that results may vary.

Some patients have unrealistic expectations based on a distorted perception of their existing tooth color. The patient with extremely white teeth from habitual bleaching may in fact believe that his or her teeth appear yellow. These patients may have an obsession with or addiction to bleaching, colloquially known as "bleachorexia," and should be advised against continual bleaching. Time should be taken to educate the patient regarding the extreme light color relative to the color of the lightest natural tooth shades. This can be accomplished by demonstrating to the patient his or her extreme white teeth next to, for example, the B1 tab from the VitaPan classical shade guide (Vita Zahnfabrik, Bad Säckingen, Germany) (see Figure 7.8).

MATERIAL SELECTION

One- and two-component systems

Some bleach formulas will combine all the component materials into one syringe, or products may package activators and additives as separate components that require mixing.

One-component systems are typically bleach formulas that do not require mixing for activation. They consist primarily of highly concentrated hydrogen peroxide as the active ingredient in a gel form matrix such as glycerin or propylene glycol, along with stabilizers or photosensitizers (see Figure 7.9).

Two-component systems may require mixing of the active ingredient with a catalyst. Some systems require hand mixing of the components (see Figure 7.10), others may use syringe-to-syringe mixing (see Figures 7.11A and 7.11B), and still others may combine the components through an automix tip of a dual-barrel syringe (see Figure 7.12).

Active agents

Carbamide peroxide has been shown to be effective for at-home bleaching (Hasson et al. 2006) when used in concentrations ranging from 10% to 22%. Higher concentrations ranging from 35% to 44% have been applied by dentists using an assisted bleaching technique. The carbamide peroxide, in this case, may be warmed and applied with a custom tray or directly to the teeth, avoiding the gingiva, and monitored in the office (Miller 1999). In-office bleaching with carbamide peroxide has generally been replaced with techniques using higher concentrations of hydrogen peroxide. Carbamide peroxide is considered less effective for in-office bleaching because of its slower rate of decomposition to form active oxygen and peroxide radicals.

Chlorine dioxide has also been used chairside by nondental providers, especially in the United Kingdom. However, because of its acidic pH, reported damage to enamel, and lack of investigation for dental use in the scientific literature to date, the dental professional has not adopted the use of chlorine dioxide for in-office power bleaching (Greenwall 2008).

Hydrogen peroxide (H_2O_2) in high concentrations ranging from 15% to 40% has been used most effectively by the dental professional as the active ingredient for in-office power bleaching. As concentration increases, fewer applications of hydrogen peroxide are usually required (Sulieman et al. 2004).

Activators and pH

pH of bleach formula

The common recommendation for professional bleaching formulas is to have a neutral pH to avoid damage to enamel (American Dental Association Council of Scientific Affairs 2009). The optimum pH for hydrogen peroxide decomposition is considered to be around 9.5 to 10.8 (Goldstein and Garber 1995). Some bleach formulas may still contain acidic components to keep the active ingredient stable. A recent study showed the bleaching effect of *acidic* 30% hydrogen peroxide versus *neutral* 30% hydrogen peroxide to be equivalent (Sun et al. 2011).

The pH becomes an important issue if it falls below the critical point of 5.2, at which enamel demineralization is expected to occur (Driessens et al. 1986, Shannon et al. 1993, Joiner 2007). However, an abundance of mineral ions found in human saliva and the formation of a natural salivary pellicle in vivo should have a protective effect against enamel demineralization (Hannig and Balz 1999, Hannig et al. 2004).

Activators and additives

In addition to hydrogen peroxide, power bleach formulas may contain proprietary activators, which may include a combination of alkaline pH adjusters, metal ions, or photosensitive catalysts to absorb and transfer energy to the peroxide and accelerate decomposition. Other added ingredients may include stabilizers for extended shelf life or materials to improve viscosity.

BLEACHING LIGHT DEVICES

The use of light to supplement the bleaching process in dentistry was reported as early as 1918 (Abbot 1918). Not until recently has the use of bleaching lights begun to become widespread. Although there are several light sources with different spectral distributions and efficiencies currently on the market, they all purport to accelerate or enhance the bleaching process. Initially, bleaching lights relied more on heat or thermal decomposition of the bleaching agent, whereas contemporary bleaching lamps aim to achieve photolysis of the bleaching agent at specific wavelengths.

Heat lamps (19th century–1980). Early bleaching lamps made use of an incandescent or photographic floodlight (see Figure 7.13). This type of light source produced a continuous spectrum with high infrared emission, which supplied a source of indirect heat. For vital teeth, temperatures were recommended in a range of 46°C to 60°C (115°F to 140°F). For nonvital teeth temperatures as high as 71°C (160°F) were recommended (Goldstein and Garber 1995). The risk of increasing the pulpal temperature beyond the critical threshold of 5.5°C, at which irreversible pulpal damage can occur, is a concern with any system that raises the temperature of vital teeth (Zach and Cohen 1965, Baik et al. 2001). The use of heating lamps has fallen out of favor for vital teeth and may be considered obsolete by today's standards.

Halogen lamps (1980s–2000). These lights are a refinement of the incandescent light source with halogen gas added. The halogen gas causes evaporated tungsten to redeposit on the filament, improving the filament life and allowing a higher color temperature than the standard incandescent lamp. The higher color temperature supplies a cooler (more blue-green) continuous spectrum of light from near ultraviolet to deep infrared filtered to the usable region for the bleaching agent (see Figure 7.14).

High-intensity discharge (HID) lamps (1990s–current). These are high-powered lamps that produce light by ionizing noble gases (xenon, krypton) or metal halides between two electrodes. Depending on the conducting elements added to the arc stream, HID lamps may properly be referred to as *metal halide lights* and are often referred to as "plasma arc lights" in dentistry. These lamps are typically wide-spectrum lamps using bandpass filters to narrow the emission primarily to the short ultraviolet to blue light (380–500 nm) (see Figure 7.15).

Light-emitting diode (LED) lamps (2000–current). These are solid-state, semiconducting energy sources that supply near-monochromatic light. LED lamps are currently one of the most energy-efficient and rapidly developing light technologies. Because LEDs produce a discrete or narrow spectrum of light, the light source requires no additional filtration of extraneous energy and produces very little heat. As a result, an LED bleaching light system is dependent less on heat and more on the wavelength-specific photochemistry of the bleaching formula and possible energy absorption of the natural tooth chromogens contributing to bleaching effect (Figure 7.16).

Lasers. The popular consumer term for in-office bleaching with any type of light is often referred to as *laser bleaching*. However, a laser by definition is a device that produces a nearly parallel, monochromatic, and coherent beam of light by exciting atoms and causing them to radiate their energy in phase (coherent). Lasers have been slow to gain wide acceptance for dental bleaching because of a lack of scientific clinical trials and the high cost compared with alternative light devices. Deleterious effects associated with increased pulpal temperature of teeth are also a concern with the use of lasers (Luk et al. 2004, Baik et al. 2001).

The role of bleaching lights in dentistry is a topic for which there has been controversy and a lack of agreement. This lack of agreement can be attributed to variability associated with methods used to measure color, different light sources, and bleaching formula interactions (Ontiveros 2011). Some clinical studies have reported significant effects with bleaching lights (Tavares et al. 2003, Ziemba et al. 2005), whereas others have shown no effectiveness (Papathanasiou et al. 2002, Hein et al. 2003). Still others have found mixed results depending on tooth inclusion (Calatayud et al. 2010) or method of color measurement (Gurgan et al. 2009, Kugel et al. 2009, Ontiveros and Paravina 2009). The trend for future lamps may rely more on specialized light sources such as LEDs or lasers rather than filtered light to illuminate the teeth. As refinements in material photochemistry and improvements in spectral properties of bleaching lamps continue, the use of supplemental light devices in dentistry is expected to remain popular and continue to grow in the foreseeable future.

MONITORING OF BLEACHING

Bleaching can be monitored using visual and/or instrumental methods. Both methods can provide credible results if used appropriately.

VISUAL MONITORING

Visual monitoring is by far the predominant method for evaluation of bleaching efficacy. The most important aspects of this method are observer and patient recruitment, shade-matching conditions, method, and tools.

Observers

It is not justified to recruit experienced practitioners or female observers for visual monitoring of tooth bleaching because there is insufficient evidence that experience and gender influence shade-matching performance for observers with normal color vision. However, significant evidence shows that differences exist among individuals of the same gender or people with similar experience. These differences can be quantified through various professional (nondental) tests such as Ishihara charts or the Farnsworth–Munsell 100-hue test. In the latter test, color discrimination ability of color-normal individuals ranges from low (16%), through average (68%), to superior (16%). There is also evidence that education and training can improve one's color-matching skills.

A simple nonprofessional test for color discrimination competency in dentistry has been suggested as mandatory according to the International Standards Organization (ISO) (International Organization for Standardization 2011). Test subjects should match pairs of tabs from two identical shade guides under controlled conditions, ideally in a viewing booth. One set of tabs should have original markings on tab holders, and the markings on the other set of tabs should be masked with custom letters, numbers or symbols. Tabs should be removed from joint tab holders, and scattered on the floor of the viewing booth. After a period of adaptation by observing the gray surface (walls of the viewing booth), the observers should begin matching pairs of tabs. One point should be assigned for each correctly matched pair. An observer who correctly matches at least 60%, 75%, or 85% of pairs corresponds to poor, average, and superior color discrimination competency, respectively. At least three observers with superior or average color discrimination competency should participate in monitoring of bleaching.

Conditions and method

Similarly to the conditions described for testing color discrimination competency, color-corrected light (such as D65) with a color rendering index (CRI) of 90 or greater should be used for visual shade matching in the dental office or laboratory. Light should be neither too intense nor too dimmed; 1000 lux is considered optimal for visual color matching.

Shade matching should be performed at the beginning of the appointment, at a distance of 25–35 cm (10–14 inches). Tabs should be either illuminated at 45° (or 2 × 45°) and observed perpendicularly (at 0°), or vice versa. A single shade-matching trial should last no more than 5–7 seconds, and a light-gray card should be observed during the breaks between two color-matching trials.

Tools and patient recruitment

The so-called value scale of the Vita classical A1–D4 (VC) shade guide is the accepted standard for bleaching monitoring. The value scale is supposed to represent a light-to-dark arrangement from B1 (shade 1) to C4 (shade 16). A visual method based on this scale depends on calculating the difference in shade guide units (SGUs) before and after bleaching. However, the VC value scale has numerous shortcomings, including the following:

- A narrow color range.
- A lack of very light shades. This results in the exclusion of a large percentage of the population from bleaching research (adding group 0 from 3D-Master is not appropriate or logical).
- An inconsistent color distribution. This is most emphasized in the range of primary interest (3–6 SGUs).
- A poor correlation with the increase in chroma from B1 to C4.

The aforementioned inconsistencies in value scale can be misleading and compromise findings to a certain extent. The lack of very light tabs (lighter than B1) excludes more than 52% of the population—for example, in studies that recruit patients with an initial shade of A3 or darker (probably the most frequent design in bleaching studies) (Paravina and Majkic 2007). The addition of group 0 (0M1, 0M2, and 0M3) from the 3D-Master shade guide to the VC value scale does not solve this problem, and it is neither logical nor appropriate: the color difference between 0M3 and B1 is too great ($\Delta E^* = 8.0$). The same is true for the difference in lightness ($\Delta L^* = 7.1$). The difference is less pronounced for the blue-yellow coordinate ($\Delta b^* = 3.7$) and the least pronounced for the green-red coordinate ($\Delta a^* = 1.0$). However, the problem with the Δa^* is that this difference is in the opposite direction: 0M3 has higher a^* than B1 (redder).

The inconsistent color distribution (lack of uniformity of color differences among the adjacent tabs) is another major concern with the classical shade guide. The average color differences (ΔE^*) among adjacent VC tabs and 2, 3, 4, 5, and 6 tabs apart are 5.4, 4.8, 6.6, 6.4, 7.8, and 7.1, respectively ($R^2 = 0.72$). Therefore, the ΔE^* between mean differences 1 and 6 tabs apart is only 1.7, whereas the difference between mean differences 3 and 6 tabs apart (majority of bleaching-dependent color differences are within this range) is only 0.5.

The Vita Bleachedguide (BG) 3D-Master is the first shade guide developed specifically for visual evaluation of tooth bleaching. The current BG has additional numeric markings as shown in Figure 7.17 (see also Figure 4.13). The existing tabs are marked with odd numbers 1 to 29, representing 29 original 3D-Master tabs, from 0M1 to 5M3. Interpolated SGUs are marked with even numbers to comply with the current ADA recommendation that 1 ccu = 1 SGU = 1 ΔE* (American Dental Association Council of Scientific Affairs 2006) and to increase precision (when a tooth shade is between two shade tabs) and sensitivity of the BG. This is justified by the finding that 1 SGU_{BG} = 2 SGU_{VC} (Paravina et al. 2007).

The manufacturer-suggested light-to-dark tab arrangement of the BG is consistent with visual observation. The BG arrangement was found to be identical to tab arrangement independently determined by a panel of observers, which was not the case with VC and some other products. The same is true for changes in chroma from the lightest to the darkest tabs (Paravina 2008).

Inclusion of very light shades into the BG complements contemporary esthetic dentistry and enables the capturing of tooth shades for patients in bleaching studies and practice that are lighter than B1. Indeed, the safe way to obtain comprehensive and credible information on bleaching efficacy of a certain agent would be documentation of tooth shade using visual shade guides designed for monitoring bleaching that overcome the shortcomings of the classic tools and are used under the correct conditions and methods for accurate shade matching.

Instrumental monitoring

The instrumental method is based on the calculation of color difference (ΔE*) before and after bleaching. Frequently used devices for instrumental color assessment in dentistry are spectrophotometers, spectroradiometers, colorimeters, imaging systems for traditional digital imaging, and spectral imaging. It is of essential importance to ensure repeated measurements of the same area through accurate repositioning of the measuring device and/or use of other methods.

IN-OFFICE VITAL TEETH TECHNIQUE

Precautionary statements and management of side effects

No anesthesia and patient monitoring

Anesthesia should *not* be used with this procedure. The doctor is monitoring for sensitivity at all times. The patient can be instructed to raise a hand to signal if any burning, tingling, or discomfort is experienced. The procedure may need to be abandoned if patient sensitivity cannot be overcome.

Sensitivity

Sensitivity should be minimized by proper screening of the patient during the initial interview and dental examination. Some of the risk factors for tooth sensitivity include existing decay, gingival recession, cervical abrasions, or a history of tooth sensitivity. Greater tooth sensitivity has been reported for in-office bleaching with adjunct light compared with no light (Ontiveros and Paravina 2009). Patients reporting a history of tooth sensitivity may prebrush for 2 weeks with a potassium nitrate–containing toothpaste to alleviate or minimize discomfort (Haywood 2005, Haywood et al. 2005). The identified high-risk patient may be provided with 600 mg of ibuprofen 30 minutes before treatment to reduce the incidence of tooth sensitivity (Charakorn et al. 2009). This may allow the patient to complete the procedure with minimal discomfort and to get the greatest benefit out of the appointment. Another strategy may be to provide a 3–6% potassium nitrate gel to the lingual surface of the teeth if the patient experiences sensitivity during the appointment.

Tissue burn or swollen lip

The ideal method to avoid chemical burn is through meticulous application of the gingival barrier. If the bleach penetrates beneath the barrier or accidental soft tissue contact is made, immediately flush the site with copious water spray and apply mineral oil, such as vitamin E. The oil should provide relief from the stinging sensation within a few minutes, and the white oxidation appearance will normally resolve within a few hours (see Figure 7.18). The patient may be provided with additional oil or topical anesthetic for home use. The need for antihistamine administration should be considered for allergic skin reactions.

White spots

Any white spot lesions or striations should be identified before the appointment if possible because they may become accentuated during the bleaching process (see Figure 7.2). As the teeth begin to rehydrate over the next 24 hours these white spots may blend, or subsequent microabrasion techniques may be planned. If the blemishes are suspected to be recent lesions, successful treatment has been demonstrated using fluoride-containing casein phosphopeptides and amorphous calcium phosphate (CPP-ACP) (Robertson et al. 2011). High concentrations of fluoride (≥5000 ppm) should be avoided because rapid remineralization of superficial enamel may impede remineralization of the deeper layer of the lesions, resulting in white enamel opacities that will not allow return to the normal opalescence of sound enamel. This is based on the rapid remineralization of the surface layer with high concentrations of fluoride and lack of remineralization with the deeper demineralized areas of clinically evident white spot lesions (Hicks 2010, personal communication).

Photosensitivity

The dentist should be aware of any patient taking phototoxic drugs or those with certain skin conditions associated with photosensitivity before using a light device for bleaching. There have been reports of patients experiencing negative skin reactions after light exposure, especially ultraviolet light, manifesting as swelling of the lips and surrounding tissues (see Figure 7.19).

Pregnant or lactating women and young children

It is most prudent to postpone treatment for pregnant or lactating women and young children as a precautionary matter. We generally advise postponement of in-office bleaching of vital teeth of young children until beyond the mixed dentition stage.

Step 1: Tray impressions

If models were not poured at a prior appointment, then impressions of the patient's teeth should be taken at the start of the in-office power bleach appointment for the fabrication of custom bleach trays. The trays allow the patient to supplement the in-office procedure with at-home bleaching to minimize any rebound effect or continue to lighten the teeth for more stubborn stains or future maintenance. The trays also can be used post-treatment for delivering desensitizing gel.

Step 2: Prophy

In preparation for bleach application, tooth plaque or superficial stain is removed using prophy paste or pumice of flour paste in a rubber polishing cup (see Figure 7.20).

Step 3: Initial shade

Document the prebleaching shade using visual and/or instrumental methods (see section on monitoring of bleaching). Patients often have a vague recollection of pretreatment color and desire to see the immediate outcome. The initial shade will be an aid in demonstrating to the patient the color change along with the post-treatment shade (step 10).

Step 4: Light-protective glasses and light guides

When using a supplemental light device, it is essential to provide the patient with light-protective eyewear to filter harmful radiation. It has been shown that many lamps exceed standards set for eye exposure to direct blue light (Bruzell et al. 2009). Protective light guides surrounding the exit window of bleaching lamps are also recommended to minimize scattered optical radiation (see Figure 7.21).

Step 5: Lip protection and cheek retraction

A barrier cream or oil is applied to the lips before insertion of the cheek and lip retractors (see Figure 7.22). Vitamin E oil (α-tocopherol), a fat-soluble antioxidant, may neutralize accidental soft tissue contact with the peroxide. If the lips are exposed to potential ultraviolet emission, then a sunblock cream may be used on the lips. Various types of cheek and lip retractors are available and suitable for in-office bleaching. Retractors that shield the lips, especially when a lamp is used, and guard the tongue from contacting the bleaching agent are preferred (see Figures 7.23A and 7.23B). The protective bib or isolation napkin is slipped over the retractors to further shield the perioral skin (see Figure 7.24).

Step 6: Gingival isolation

After retractors are in place, long cotton rolls are placed in the vestibules. A light-cure resin barrier material is carefully applied using a small-tipped syringe at the gingival crest to protect the gingiva from chemical burn. When a bleaching light device is used, additional resin barrier material is extended apically 5–10 mm and sealed against the cotton rolls to protect the gingiva from light radiation. The barrier is completely cured by waving the light tip back and forth for 1–2 minutes (approximately 10 seconds per tooth). Unfolded gauze squares can be placed to cover the remaining soft tissue exposed in vestibules. The material is initially cured for 2–3 seconds, two teeth at a time. Care should be taken to seal the gingival crest from one papilla tip to the next without overlapping too much onto the tooth yet ensuring that no gingival tissue is exposed. The curing light tip should remain moving because some materials are exothermic and high-powered lights can cause soft tissue discomfort for the patient (see Figures 7.25A–G).

Step 7: Activation of bleach, if required

A syringe-to-syringe mixing product will require the user to attach the syringe with the bleaching agent to a second syringe with the activator. The contents of one syringe are then pushed into the other, going back and forth about a dozen times until completely mixed and finally pushing all contents back into one syringe before applying the applicator tip (see Figures 7.11A and 7.11B). Bleach materials that have been refrigerated should be brought to room temperature or slightly warmer by placing them in a water bath, or should be warmed in running water (see Figure 7.26).

Step 8: Application and reapplication of bleach

The bleach material is applied to the teeth in a layer 1–2 mm thick, generally for 15–20 minutes per application with three or four applications per session (see Figures 7.27A and 7.27B). To avoid bleach splatter and dislodgement of the barrier material, surgical suction is used to remove the bleach between repeat applications of fresh material. If patient experiences any burning, immediately suction off the bleach and thoroughly rinse. To avoid dislodgement of the barrier material, surgical suction is preferred over high-volume suction (see Figure 7.28). If the gauze gets wet, it can be replaced with dry gauze between applications. The cotton rolls attached to the gingival barrier should remain in place between applications so as not to disturb the barrier.

Step 9: Removal of barrier

At the end of the bleaching session the resin barrier is ready for removal and typically can be lifted in one piece by grabbing hold of the attached cotton rolls or dislodged using an explorer instrument (see Figures 7.29A and 7.29B).

Step 10: Postbleaching shade

The post-treatment shade is taken to document the color change for the patient record and to demonstrate to the patient the immediate outcome (see Figure 7.30 and section on monitoring of bleaching).

Step 11: Postbleaching instructions

Postbleaching instructions may include a recommendation to wait a minimum of 6 hours after in-office bleaching before drinking any chromogenic drinks such as coffee or grape juice (Ontiveros et al. 2008). Patients requiring pretreatment ibuprofen for sensitivity may benefit from an additional dose immediately after the appointment (Charakorn et al. 2009). To maintain the bleaching results, the patient can be provided a custom at-home bleach tray for periodic maintenance or for continued bleaching using the combination technique.

IN-OFFICE/AT-HOME COMBINATION EXAMPLES

An in-office/at-home combination bleaching technique can be offered as an alternative. The combination technique has been shown to be more effective than in-office bleaching alone (Matis et al. 2009). This technique allows patients to use a custom tray at home after the in-office procedure to accentuate the bleaching effects, or for longer term treatment as in cases of moderate intrinsic staining (see Figures 7.31A and 7.31B). The custom bleach trays are delivered at the completion of the in-office procedure, instructing the patient to start bleaching after 24 hours if further bleaching is desired. If immediate results are satisfactory, the patient may reserve the trays for touch-up bleaching at-home. Patients who reject or cannot wear a bleaching tray at home for one reason or another should be prepared for the possibility of multiple in-office treatments to achieve an optimal result.

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Figure 7.1

Postbleaching color mismatch.

Figure 7.2

White spot lesions after bleaching.

(A) (B)

Figure 7.3

Class I, moderate discoloration; vital case. (A) Pretreatment shade A4 from extrinsic stain and aging. (B) Post-treatment shade A1 after three 15-minute cycles with 28% hydrogen peroxide using supplemental light (high-intensity discharge [HID] lamp).

Figure 7.4

Class II, mild intrinsic stain; vital case. (A) Vital single central incisor before treatment. (B) In-office treatment with 38% hydrogen peroxide, three 20-minute applications, external application only. (C and D) Good response to treatment after a single in-office visit shown 6 days after treatment.

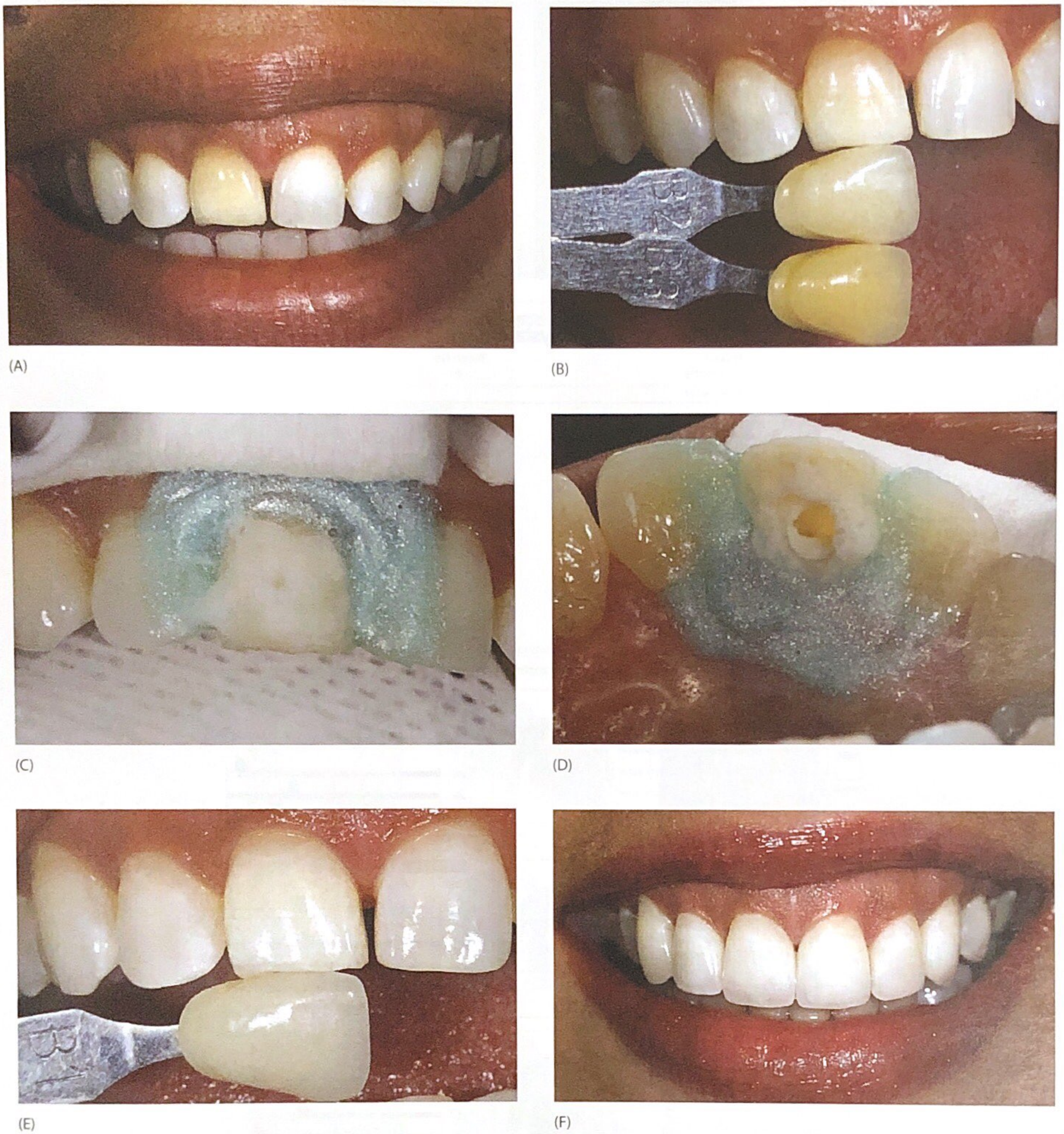

Figure 7.5

Class II, mild intrinsic stain; nonvital case. (A) Nonvital single central incisor before treatment. (B) Pretreatment shade is documented. (C) In-office treatment with 35% hydrogen peroxide applied on the labial tooth surface and (D) on the lingual surface applied both externally and internally within the pulp chamber after sealing the gutta percha 2 mm below the cementoenamel junction with resin ionomer. (E) Successful bleaching outcome after 1-hour treatment. (F) Patient elected to close spaces with translucent porcelain veneers.

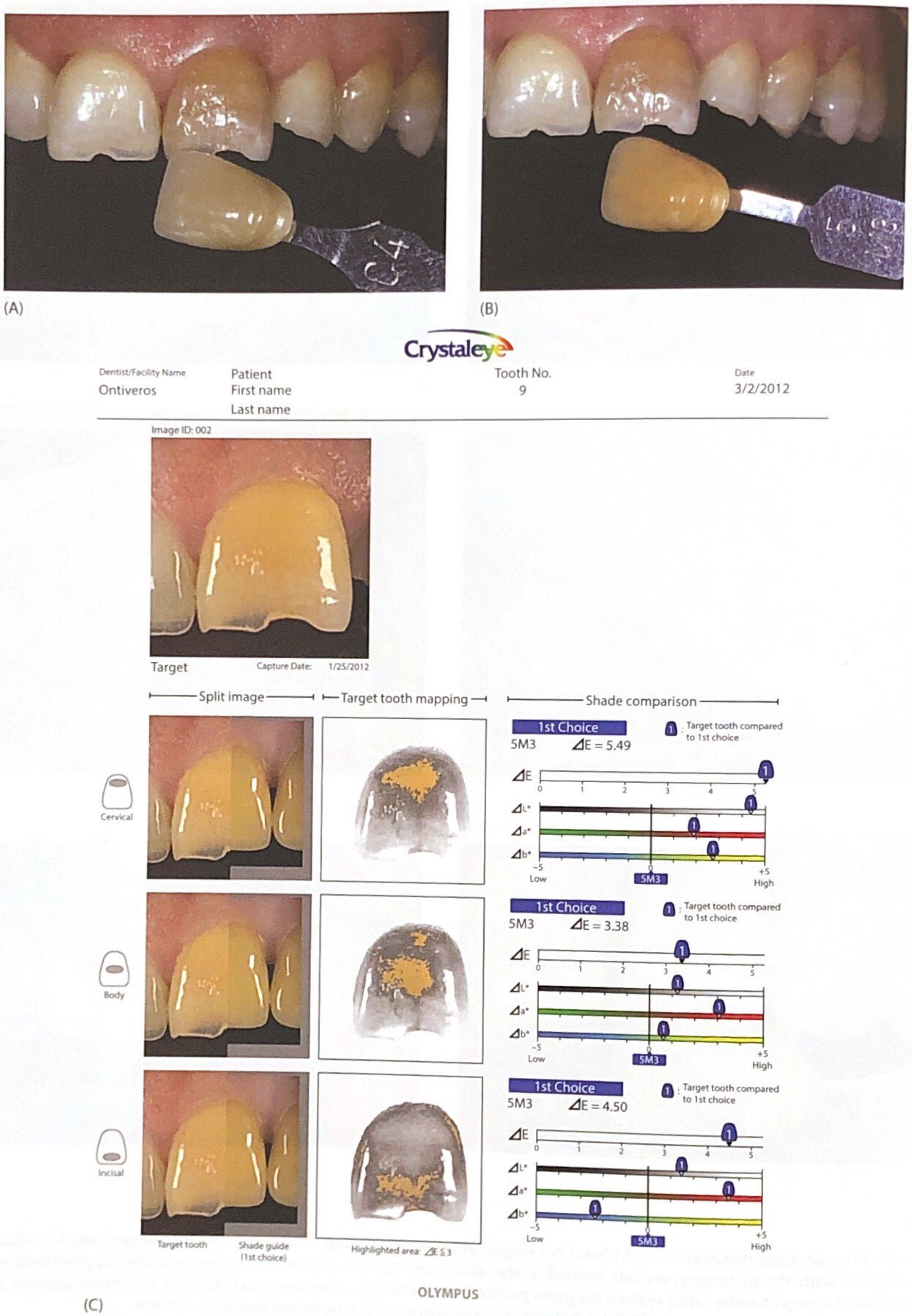

Figure 7.6

Class III, severe intrinsic stain; nonvital case. (A) Severe discoloration of nonvital tooth, which appears darker than the last shade of the Vita classical shade guide (C4). (B and C) Tooth matches more closely to the last shade of the Vita Bleachedguide (5M3), yet is more reddish as verified instrumentally.

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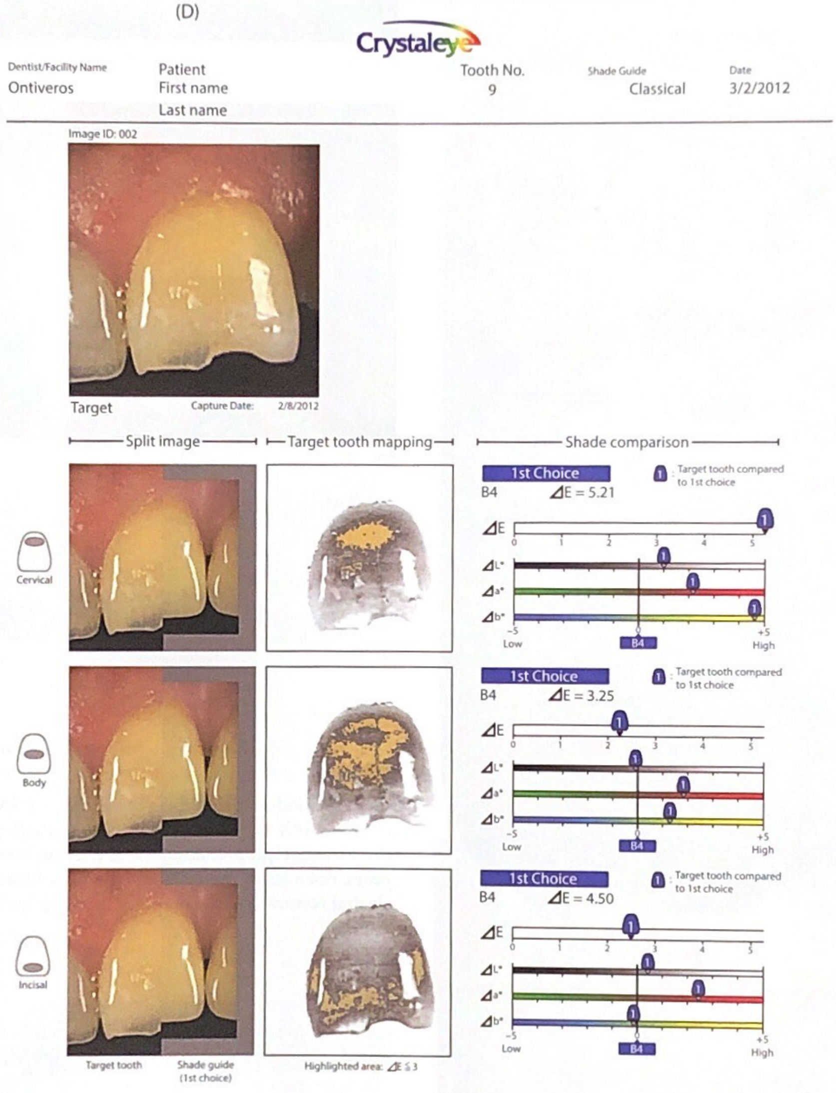
(D)



(E)

Figure 7.6 continued

Class III, severe intrinsic stain; nonvital case. (D and E) Color change after three weekly applications of sodium perborate with 3% hydrogen peroxide using the "walking bleach technique" matches closely to shade B4. Although a color mismatch still exists, the patient was pleased with the improved outcome and elected to discontinue treatment.

(A)

(B)

(C)

(D)

Figure 7.7

Class III, moderate intrinsic stain; vital case. (A) Intrinsic discoloration of vital tooth as a result of trauma. (B) Radiograph of central incisor shows dense pulp chamber and root resorption present for several years; not a good candidate for in-office bleaching. (C and D) Patient elected restorative coverage with opaque composite resin.

Figure 7.8

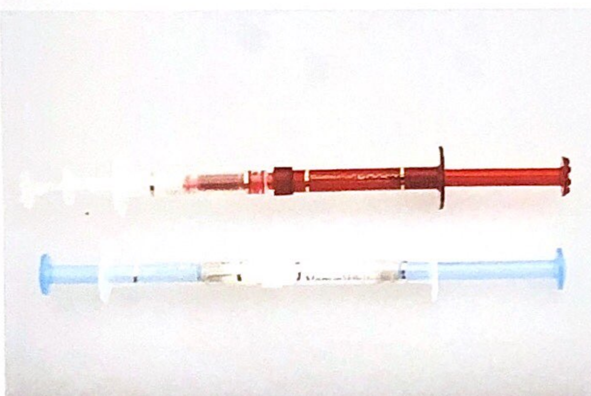
Overbleached teeth. Educate patient with extremely white teeth by showing contrast with light shades of the Vita classical shade guide.

Figure 7.9

One-component system; no-mix formula. Examples of 25% hydrogen peroxide supplied in ampules (PowerBrite) and 30% hydrogen peroxide supplied in syringe (Dash).

Figure 7.10

Two-component system (Beyond, Stafford, TX) that requires hand mixing 35% hydrogen peroxide with a silicon dioxide catalyst.



(A)

(B)

Figure 7.11

Two-component systems that use syringe-to-syringe activation. (A) Forty percent hydrogen peroxide (Opalescence Boost, Ultradent Products, South Jordan, UT) and 38% hydrogen peroxide (Venus White Max, Heraeus Kulzer, South Bend, IN) ready for mixing. (B) For mixing, the syringe of hydrogen peroxide is connected to a separate catalyst syringe and is pushed to and from the catalyst syringe until completely mixed.

Figure 7.12

Two-component system that combines 25% hydrogen peroxide (Zoom, Philips Oral Healthcare, Stamford, CT) with catalyst using an automix tip from a dual-barrel syringe.

Figure 7.13

Heat lamp. Early bleaching lamp from New Image. This lamp could be used on a bracket table for bleaching multiple vital teeth. (Courtesy of Edward J. Swift, Jr, University of North Carolina at Chapel Hill School of Dentistry.)

Figure 7.14

Modern halogen lamp. Polus Bleach Light by Beyond is marketed as a multifunctional-system halogen-powered bleaching light, light-emitting diode (LED) curing light, and low-level laser therapy (LLLT) light.

Figure 7.16

Light-emitting diode (LED) bleaching lamp. LED lamps produce near-monochromatic light using LED arrays as a light source—for example, Zoom WhiteSpeed.

Figure 7.15

High-intensity discharge (HID) lamp. HID lamps are typically metal halide lamps with light sources that filter down to the violet-blue region of the visible spectrum—for example, Zoom AP.

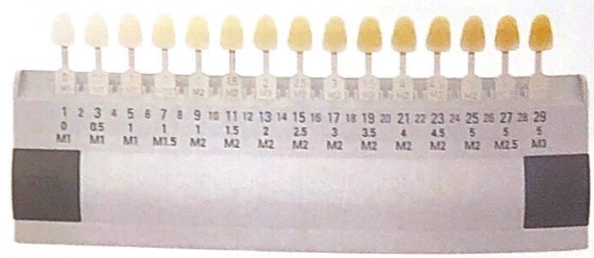


Figure 7.17

Shade guide designed for bleaching monitoring: Vita Bleachedguide with new markings.

Figure 7.18

Chemical skin burn from 30% hydrogen peroxide.

Figure 7.19

Swollen lips.

Figure 7.20

Re-treatment prophy to remove plaque and superficial stain.

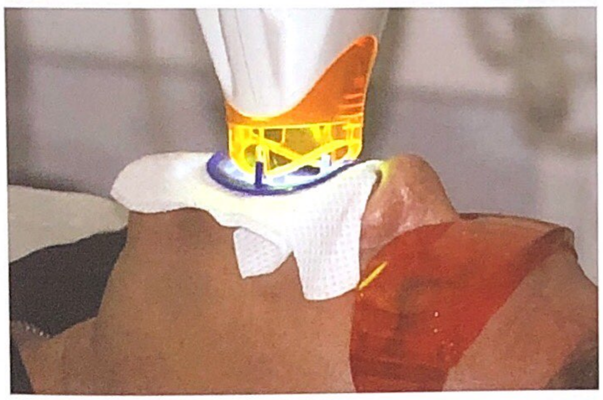


Figure 7.21

Light-protective glasses provided to patient and light guide or shield around the exit window of the lamp are used to control direct and scattered radiation.

Figure 7.22

Vitamin E oil being applied to lips.

(A)

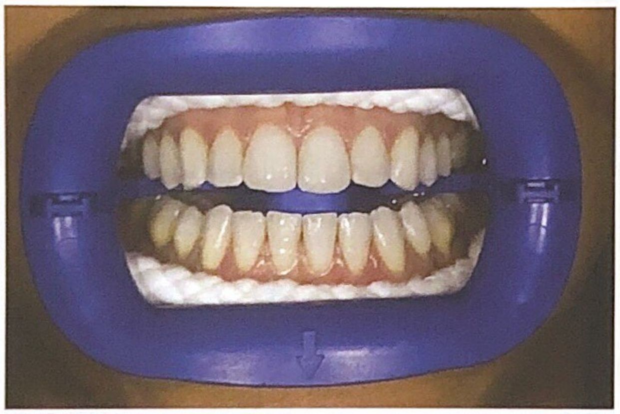
(B)

Figure 7.23

(A) Cheek retractors of various sizes and levels of protection are available. (B) Lip coverage with retractors is preferred when a bleaching lamp is used.

Figure 7.24

A protective bib or isolation napkin is slipped over the retractors.

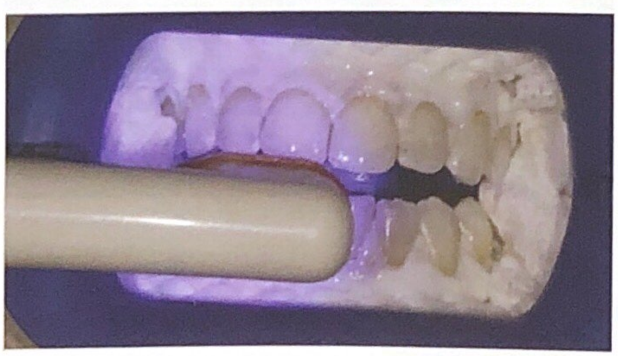


(A)

(B)

(C)

(D)



(E)

Figure 7.25

(A) Long cotton rolls are placed in vestibules. (B) Folded gauze may be placed to further protect soft tissue. (C) Resin barrier material being placed two teeth at a time and tacked in place. (D) Resin barrier material is scalloped from papilla to papilla. Tooth 9 shows an inadequate seal at the gingival crest that was corrected before application of bleach material. (E) Additional resin barrier material is extended apically 5–10 mm and cured while slowly moving the curing light to avoid overheating.

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(F)

(G)

Figure 7.25 continued

(F) Excess barrier tooth coverage can be corrected by chipping excess with a sharp No. 15 blade. (G) Barrier seal is completed and ready for bleach application.

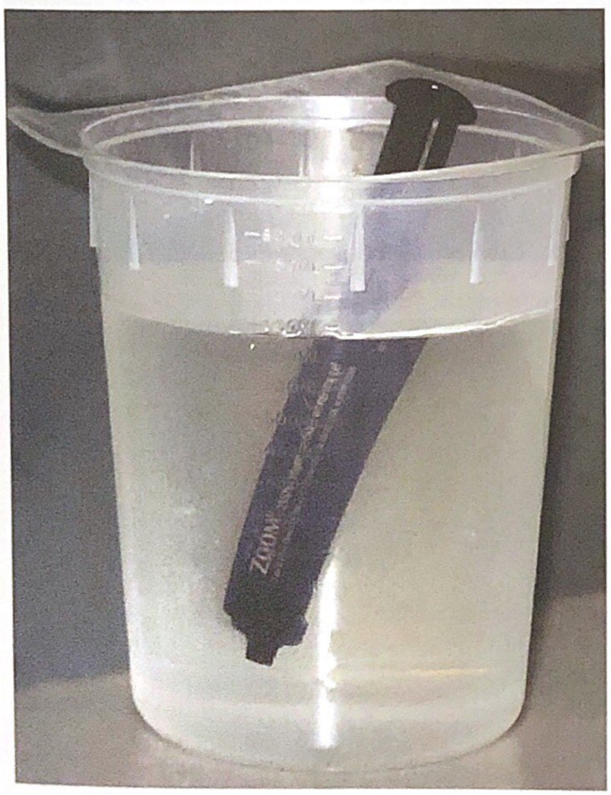


Figure 7.26

Some manufacturers recommend refrigeration storage and then warming the bleach in warm water before the appointment.

(A)

(B)

Figure 7.27

Material application can be (A) applied directly to the teeth using an automix syringe or (B) painted on using a disposable applicator brush.

Figure 7.28

Surgical suction.

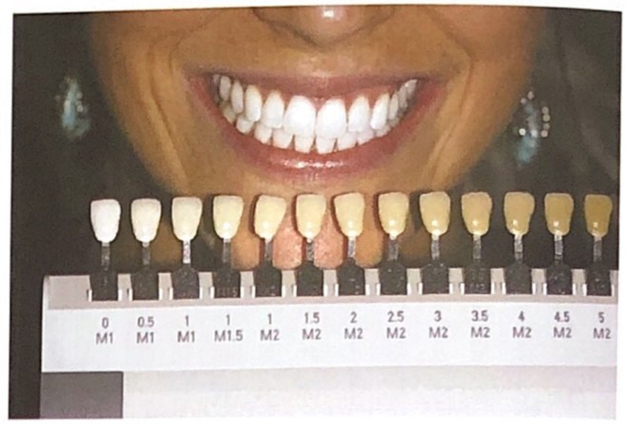
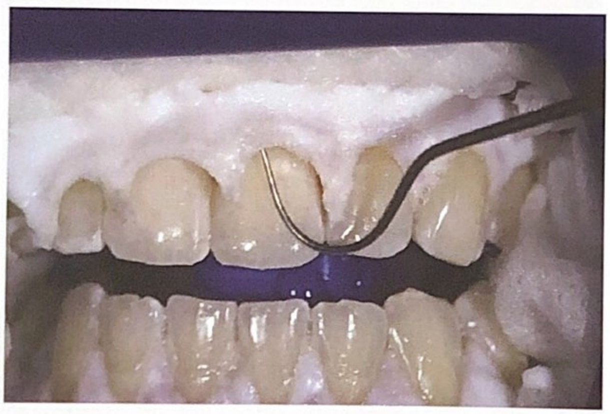


Figure 7.30

The same shade guide used to show the patient the initial shade is used for comparison with the final outcome shade. A shade guide designed to monitor bleaching can capture an extreme white shade after bleaching.



(A)

(B)

Figure 7.29

(A) Resin barrier is engaged with an explorer and removed in one piece. (B) Cotton roll and barrier often can be removed in one piece.

(A)

(B)

Figure 7.31

(A) Moderate fluorosis staining. (B) After treatment using a combination technique.