



# Bleaching Tetracycline-Stained Teeth

## Considerations and recommendations for treatment

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In order to understand how to successfully bleach tetracycline-stained teeth, one must first understand the basics of bleaching normal teeth. When considering bleaching, most dentists choose the most cost-effective, safest, and efficacious technique for both the dental office and the patient, which is generally recognized to be overnight tray bleaching using a 10% carbamide peroxide bleaching agent—the most researched ADA approved bleaching material.<sup>1</sup> In bleaching cases involving tetracycline-stained teeth, the extended time required for the teeth to change color makes choosing the appropriate bleaching material and technique even more important in terms of both cost and safety. When addressing patients, the word “bleaching” should be used instead of “whitening.” Although many over-the-counter products claim that they can produce “whitening” that rivals dentist treatments, “whitening” removes surface stains only, whereas “bleaching” changes the inherent color of the teeth. The following article compares and contrasts tray-bleaching techniques for normal teeth with those for tetracycline-stained teeth.

### How Teeth Respond to Bleaching

Every patient's teeth respond differently to bleaching, both in the level of bleaching that they obtain and how quickly that bleaching occurs. Depending on the final shade desired, overnight tray bleaching of normal discolored teeth takes approximately 3 days to 6

weeks with an average time of about 2 weeks.<sup>2</sup> Comparatively, tetracycline-stained teeth can take 2 to 12 months or longer to bleach using the same method.<sup>3</sup> Although they do not necessarily become “white,” the average time for tetracycline-stained teeth to lighten is 3 to 4 months (Figure 1 and Figure 2). The final outcome of bleaching tetracycline-stained teeth depends on their initial color and the consistency of the color. Tetracycline is available in several analogues, which induce different colors in the teeth. Gray discolorations are the hardest to bleach, whereas brown and yellow discolorations respond better. All teeth will lighten with bleaching; it is the extent to which they will lighten and the uniformity that is unpredictable (Figure 3 and Figure 4).

When bleaching treatment is initiated for normal teeth, there may be minimal color change for a day or two, then the teeth begin to significantly lighten. The teeth will continue to lighten until they reach an endpoint or plateau, which is determined by their composition, not the product or technique. This contributes to the unpredictable nature of bleaching. Once the teeth reach their maximum whiteness, any further treatment or use of different products/concentrations will fail to improve that shade. Teeth look the best when they match the color of the sclera of the eyes, which is the desired endpoint for bleaching.<sup>4</sup> However, because the final shade is unpredictable, promising achievement of a super-light shade can result in patient dissatisfaction with the treatment.

When bleaching treatment is initiated for tetracycline-stained teeth, a slight color change may occur during the first few days, followed by no observable change for a month or so of treatment. After approximately 1 to 2 months, the teeth will begin to lighten in the same manner as normal teeth, progressing until they reach their maximum whiteness potential (Figure 5 and Figure 6). Although the average treatment requires 3 to 4 months of nightly bleaching with 10% carbamide peroxide, reaching the maximum whiteness could take as long as 15 months, depending on the initial color and location of the tetracycline staining. To ensure that the lightest shade possible is achieved, before terminating treatment, the patient should continue bleaching for an entire month despite no discernible color change.

### The Importance of the Bleaching Examination

Prior to using any bleaching technique, a proper examination and analysis of the smile should be conducted.<sup>5</sup> In addition to the smile itself, this evaluation should include the entire face and account for the sclera of the eyes. The examination should evaluate the extent of the teeth visible in the full smile because the gingival areas of teeth do not bleach as well as the incisal portion (Figure 7 and Figure 8). This difference in tooth response exists because the tooth is thicker at the gingiva—with less enamel and more dentin—and the composition of the dentin varies from the incisal to the root tip. With tetracycline-stained teeth, the gingival area is even more difficult to bleach. This is because the tooth color comes primarily from the dentin where the tetracycline molecule is more tightly bound (Figure 9 and Figure 10).

When planning to bleach normal teeth, identification of a “gummy smile” is important because whiter teeth will make it more noticeable. Periodontal therapy for altered



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**(1.)** Preoperative tetracycline-stained teeth to be bleached nightly with 10% carbamide peroxide in a non-scalloped, no-reservoir tray. **(2.)** Overnight bleaching of one arch for 3 months to 4 months with 10% carbamide peroxide shows improvement, but not as significant as normal teeth would demonstrate. **(3.)** Preoperative tetracycline staining in a bruxism patient often requires several trays for extended treatment. **(4.)** Posttreatment with 10% carbamide peroxide, teeth are lighter, but not white. One arch treatment improves compliance and helps demonstrate effectiveness. **(5.)** Moderately tetracycline-stained teeth that demonstrate uniform discoloration without severe gingival discoloration. **(6.)** Several months of overnight treatment with 10% carbamide peroxide yields a reasonable outcome, which greatly pleased the patient.

passive eruption may be indicated prior to bleaching to expose more of the teeth and eliminate the excessive gingival display, which can reduce the need for bleaching. In order to appear normal, most teeth should be at least 10 mm in length. The presence of a gummy smile may be less of a problem when planning to bleach tetracycline-stained teeth. Because their gingival areas are often darker and do not respond as well, tetracycline-stained teeth will not create the same sharp contrast with the gingiva that is observed in a gummy smile with lighter teeth.

Existing restorations revealed in a full smile should be evaluated for visibility and criticality of color because they will not lighten with bleaching, regardless of the material. Some surface stain removal may occur on composites, but the basic color of the

restorations will remain the same. Therefore, if a restoration matches the existing color of the tooth, it may become unesthetic after bleaching and need to be replaced. Patients must clearly understand the financial implications of replacing unesthetic, tooth-colored restorations for an additional fee, because that cost may present an obstacle to proceeding with bleaching.

Periodontal conditions and gingival recession should be evaluated during smile analysis because exposed roots do not bleach. Tetracycline-stained teeth are even darker at the gingival than normal teeth, so the expectations of these patients should be adjusted to a less-than-ideal outcome. In addition, the smile analysis for both types of teeth should include an evaluation for gingival disharmony because lightening teeth with bleaching

will accentuate any less-than-ideal areas (Figure 11 and Figure 12).

As with normal teeth, tetracycline-stained teeth should be examined for existing decay. Because the decay process is halted during bleaching with 10% carbamide peroxide, small non-sensitive caries do not have to be restored prior to treatment.<sup>6</sup> However, if a deep or sensitive lesion is detected, a protective restoration using a resin-modified glass ionomer (RMGI) can be placed prior to initiating bleaching. Because predicting the final bleaching color outcome is impossible, the shade selection for the RMGI must be estimated. After bleaching is complete, if the RMGI no longer matches or has the desired surface gloss, its surface can be removed, leaving the deeper portion as a base. Then a composite resin that matches the shade of the bleached teeth can be bonded to the RMGI and surrounding enamel to achieve better esthetics.

### Sensitivity during Bleaching

All patients who are considering bleaching treatment should be evaluated for a history of sensitivity. Those with existing sensitivity issues are more likely to experience increased sensitivity during bleaching. Sensitivity during bleaching treatment results from the easy passage of the peroxide through the intact enamel and dentin and into the pulp, which occurs in 5 to 15 minutes.<sup>7</sup> Bleaching sensitivity is a transient pulpitis resulting from this easy passage, and higher concentrations of bleaching materials will result in greater sensitivity.<sup>8</sup> In addition, sensitivity can be caused by occlusal problems related to the tray.

Beyond using a low concentration of carbamide peroxide and a proper-fitting tray, the addition of a 10 to 30 minute tray application of 5% potassium nitrate prior to or after bleaching treatment can help reduce associated sensitivity.<sup>9</sup> Potassium nitrate is found in most desensitizing toothpastes in the United States, but is less used in other countries. With various professional products available for dispensing potassium nitrate, it can be applied by brushing with a toothpaste, using it in the tray instead of the bleaching material, or incorporating it into the bleaching material. When applied using the tray, a 5% potassium nitrate toothpaste worn for 10 to 30 minutes will successfully reduce sensitivity in more than 90% of bleaching patients. For patients with a history of sensitivity, brushing with a desensitizing toothpaste containing 5% potassium nitrate for 2 weeks prior

to beginning bleaching treatment can significantly reduce bleaching sensitivity.<sup>10</sup>

Sensitivity generally occurs during the first 2 weeks of bleaching treatment. Although the tetracycline-stained patient will require bleaching treatment that lasts for many months, the sensitivity does not usually become progressively worse. To further reduce sensitivity issues, practitioners should wait 2 weeks after a prophylaxis before initiating bleaching, during which time the patient can brush with a desensitizing toothpaste.

### Screening Radiographs

Before the initiation of bleaching treatment, a screening radiograph should be taken of the anterior teeth and any individual dark teeth to determine the cause of their discoloration. Oftentimes, an abscessed tooth or internal or external resorption fails to exhibit any associated signs or symptoms other than tooth discoloration. In tetracycline-stained teeth, these color variances are more difficult to recognize. Additionally, calcific metamorphosis, in which the pulp chamber is fully or partially obliterated by the deposition of secondary dentin, can cause a tooth to appear darker. The screening radiograph can also be useful in determining the presence of any interproximal caries or periapical cysts or tumors that could be contributing to the darkened appearance of a tooth or teeth.

### Bleaching Materials

Different patient instructions are required for each of the two most used bleaching materials: carbamide peroxide and hydrogen peroxide. Carbamide peroxide is composed of hydrogen peroxide and urea. Because it is active for 6 to 10 hours, carbamide peroxide is best used in overnight tray bleaching.<sup>11</sup> Hydrogen peroxide is only active for 30 to 60 minutes, so it is more appropriate for use during the day. A 10% carbamide peroxide product is comparable to a 3.5% hydrogen peroxide product. Because carbamide peroxide has a longer activity time, it requires less treatments to reach the same shade when compared with the use of hydrogen peroxide during the day. For normal teeth, patient preference and lifestyle can determine the most appropriate material and wear time. However, for tetracycline-stained teeth, overnight tray bleaching with 10% carbamide peroxide is the most time-efficient and results in a high rate of patient compliance.



(7.) Tetracycline discoloration is not located at the difficult gingival area in this patient, which improves the prognosis. (8.) Four months of nightly bleaching yields an excellent result due to the type and location of the tetracycline staining. (9.) Tetracycline discoloration at the gingival area is less predictable, especially with multiple analogs causing different discolorations. (10.) Bleaching yields improvement, but not much change at the gingival area, even with use of a non-scalloped tray. (11.) Moderately tetracycline-stained teeth with exposed root surfaces require informing the patient of the prognosis of the exposed root. (12.) Six months of nightly bleaching with 10% carbamide peroxide lightens the teeth, but the root surfaces remain discolored.

A pH level below 6.8 is necessary for tooth decay to occur in dentin, and a pH level below 5.5 is necessary for it to occur in enamel. Because carbamide peroxide has urea, it elevates the pH level of the mouth above 8.0, significantly reducing patients' ability to develop tooth decay during bleaching treatments. Hydrogen peroxide has a pH of 5, so it does not favor tooth protection. Because of the long-term tray wear necessary in the treatment of tetracycline-stained teeth, the use of 10% carbamide peroxide overnight is recommended.

### Tray Fabrication

The bleaching tray design selected should be informed by the product to be used, its concentration, and the specific needs of the patient. Products containing 10% carbamide peroxide were originally designed to treat the gingivae as an oral antiseptic (eg, Gly-Oxide®).

Therefore, when planning to use a 10% carbamide peroxide bleaching material, trays can be made that extend 1 to 2 mm onto the gingival tissue for a more comfortable fit and a better seal to retain the material. The gingival health of patients involved in bleaching research projects using this concentration and tray type has been shown to improve during bleaching. The use of carbamide peroxide concentrations higher than 10% requires scalloping the tray so that the material does not come in contact with the gingival tissue and potentially cause a burn. For long-term wear to treat tetracycline-stained teeth, the non-scalloped tray with 10% carbamide peroxide provides the most efficient bleaching possible with the least gingival or tooth sensitivity.

In tray fabrication, spacers or reservoirs are not needed to bleach teeth; they are designed to account for tight or ill-fitting trays.



FIG. 13



FIG. 14

(13.) Porcelain veneers were placed over tetracycline-stained teeth prior to attempting bleaching, which often requires more opaque veneers.

(14.) Nightly bleaching with 10% carbamide peroxide for 4 months lightens the teeth, which can change the apparent shade of the veneers if they are not too opaque.

follow-up appointment, this form can be used by the dentist to help determine a fair cost for the patient, including the amount of material needed for another month of treatment and an additional office visit. To further reduce the cost, the dentist should use a company that offers refills to sell to patients instead of full kits. Because they can potentially save money, patients tend to become very efficient with the bleaching material. This “pay as you go” approach benefits both the patient and the dentist. The patient can anticipate the monthly cost, and the dentist does not lose money from unanticipated extended treatment times. At each appointment, the dentist and patient can determine if another month of treatment is needed or if it is time to begin bleaching the mandibular arch.

### Single Arch Treatment

The dental practice needs to offer a single arch fee. The best way to maximize patient compliance and compare progress from the baseline shade is to treat only one arch at a time. In addition, patients can become discouraged from initiating treatment by a higher fee that includes both arches and may have other reasons for wanting to bleach the maxillary arch only. In bleaching research projects performed free of charge to the participants, surprisingly, some patients choose not to bleach the mandibular arch—even at no cost. The option of wearing only one tray has several other advantages. Because there is only one thickness of material between the teeth, this approach minimizes the impact of tray bleaching on occlusion, which can reduce mechanical tooth sensitivity and eliminate potential joint problems. And because fewer teeth are being treated simultaneously, overall tooth sensitivity can be reduced as well. Single arch bleaching treatment is especially indicated in long-term treatment situations, such as for tetracycline staining, because patients can otherwise lose their reference for how dark their teeth were prior to treatment and become dissatisfied that limited progress is being made. Using a single arch approach provides many advantages, including reduced impact on occlusion, reduced overall sensitivity, and most importantly, increased patient compliance and satisfaction.

### Patient Compliance

Maintaining patient compliance for 2 to 6 months of at-home bleaching treatment for tetracycline-stained teeth may seem daunting

A proper alginate impression (ie, the material is allowed to set properly in the tray before use, held in the patient’s mouth for the appropriate manufacturer recommended time, and used to pour the model within 15 minutes to 45 minutes without bubbles) can be used to create an excellent fitting, non-scalloped, no-reservoir tray for 10% carbamide peroxide bleaching. Not using reservoirs both conserves the amount of bleaching material used and increases the comfort to the patient, especially during the extended bleaching times required to treat tetracycline-stained teeth.

### Composite Bonding

Because bleaching materials penetrate the teeth and release oxygen, when bonding is performed immediately after bleaching, the bond strength between the composite and the enamel is reduced by approximately 50%.<sup>12</sup> Therefore, dentists should avoid initiating bonding procedures until 2 weeks after bleaching treatment to give the oxygen time to dissipate. The oxygen released during bleaching also affects the shade of the teeth, so patients should not bleach for 2 weeks prior to a shade being taken for a crown or composite. Because some patients may be using over-the-counter

products unknown to the dental office, it is important that the receptionist also question them about any of these products that they may be using before scheduling an appointment that involves bonding or shade matching.

### Fees for Extended Bleaching Treatments

The non-specific and longer treatment times required to bleach tetracycline-stained teeth create a unique challenge for the practitioner concerning fees. If quoted a price for the full treatment time, the potential bleaching patient could be discouraged from proceeding with the treatment. One successful model involves charging a reasonable initial bleaching fee for the maxillary arch, while educating the patient that any subsequent treatment and material refill costs will depend on the length of the bleaching process. Nationally, one arch of at-home bleaching averages around \$285, which includes the examination, the radiograph, the tray, and the bleaching material. A typical bleaching kit will treat one arch for roughly 4 weeks, and a form can be used by patients to keep track of how quickly they are using the syringes as well as to record any color changes or sensitivity. At the 1-month,

to the dentist. However, with careful treatment presentation and patient understanding of the benefits, it can be achieved. Much like adjusting to a bruxism splint or an anti-snoring device, with nightly wear, patients can become accustomed to the use of a whitening tray. The use of 10% carbamide peroxide for long-term wear is ideal for a number of reasons. Compliance is better with overnight tray use, and the patient gets the greatest benefit per application due to its longer activity time, which reduces cost. For example, when using carbamide peroxide, approximately 50% of the peroxide is depleted within 1 to 2 hours. However, the remaining material will continue to release peroxide for another 2 to 6 hours. Therefore, if the patient only bleached for 2 hours before removing the tray, he or she would be discarding half of the active material, greatly reducing the efficiency of the individual treatment and unnecessarily increasing the cost of the bleaching process.

### Bleaching vs Veneers

Several factors should be considered when choosing whether or not to bleach tetracycline-stained teeth. Because the teeth lighten from the incisal to the gingival, the location of the darkened areas will have an impact on the final result. Teeth with the darkest discoloration at the cemento-enamel junction, especially dark, blue-gray areas, have the poorest prognosis for full lightening, whereas teeth with discoloration in the incisal third have the best prognosis. Teeth that are not able to be fully bleached at the gingival third may be good candidates for porcelain veneers. Bleaching prior to veneer preparation can help determine if veneers are necessary, and when they are, it can better their

esthetics by providing lighter teeth as a starting point. Alternatively, teeth can be bleached from the lingual after veneer placement (Figure 13 and Figure 14).<sup>13</sup> In cases involving tetracycline-stained teeth, when bleaching treatment is attempted prior to recommending veneers, patients can be confident that the most conservative treatment plan was used to achieve the most esthetic result.

### Conclusion

Although the tooth discoloring effects associated with tetracycline ingestion in children have been recognized in the medical field for some time, tooth staining associated with adult ingestion of tetracycline analogs (eg, minocycline for acne treatment) also has been reported.<sup>14</sup> Because of the drug's continued use to treat acne and other infections, such as Rocky Mountain spotted fever, tetracycline staining will continue to occur. Due to its financially and clinically conservative approach, bleaching should be the initial treatment for patients with tetracycline-stained teeth.<sup>15</sup> Whether the case involves tetracycline-stained teeth or normal teeth, the most effective, cost-efficient, and safest bleaching technique is at-home, overnight bleaching with 10% carbamide peroxide in a non-scalloped, no-reservoir tray. 🌸

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# Determining Appropriate Fees for Tooth Bleaching

Tips for approaching treatment and coding it in a cost-efficient manner

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**D**etermining appropriate fees for tooth bleaching in a dental office should take into account several considerations, which are based upon the diagnosis of the cause of discoloration and the patient's concerns. The national average cost of tray bleaching is between \$260 and \$320 per arch, which includes the examination, screening radiographs, impressions, trays, and other needed materials.<sup>1</sup> Tooth "bleaching" materials are generally different from tooth "whitening" products that are marketed as toothpaste and other over-the-counter dentifrices. "Whitening" products generally only remove the stains from the external surfaces of the teeth, whereas "bleaching" products penetrate deep within the tooth structure, changing the internal color of the tooth, which resides in the dentin.<sup>2,3</sup> When offering tray bleaching to patients, consider the following tips to help determine the most appropriate treatment and the most cost-effective way to code for the treatment rendered.

## One Arch at a Time

The American Dental Association's (ADA) code for external bleaching for home application is D9975, which is a "per-arch" treatment.<sup>4</sup> Surprisingly, the results of early bleaching research indicated that almost

50% of patients who bleached their top arch chose not to bleach their bottom arch, even when it was offered at no cost and they were without previous bleaching problems. Some patients have stated that because no one sees their bottom teeth, they simply have no further interest in pursuing bleaching treatment. Therefore, approximately 50% of patients who are interested and willing to pay for top-arch bleaching find bleaching their bottom arch to be an unnecessary investment in time and money. In addition, bleaching one arch at a time can improve patient compliance because the color contrast between arches is visually evident (Figure 1). Moreover, one-arch bleaching helps with the reduction of generalized sensitivity because there are less teeth involved, and it helps to avoid occlusal issues because only a single tray is worn during the treatment. Lastly, a "one-arch" fee is all that is required if one arch is a denture that opposes a patient's natural teeth. Therefore, dental offices should offer a one-arch fee to patients as a viable treatment plan option.

## Single Dark Tooth Bleaching

A single dark tooth that is contraindicated for root canal therapy can be bleached externally using a "single-tooth" bleaching tray.<sup>5,6</sup> Because peroxide passes through intact enamel and dentin and gets to the pulp in 5 to 15 minutes, it is unnecessary to open the pulp

chamber or perform an endodontic therapy to obtain internal access. A vital single tooth can be bleached just as easily from the "outside in" as from the "inside out." The bleaching code for a single dark tooth tray is the same as a "per-arch" full tray (ie, D9975). The difference is in the tray fabrication, which only allows the bleaching material to contact the single dark tooth without changing the shade of the adjacent teeth (Figure 2). This allows the opportunity for the single dark tooth to either match the color of the adjacent teeth or become lighter than the adjacent unbleached teeth. In the latter case, an additional full tray is fabricated on the same cast, and the adjacent teeth are bleached to match the new shade.

Depending on the approach to treatment, a single, dark endodontically-treated tooth presents several options for the fees and codes. A single dark tooth that has received endodontic therapy can be bleached from the inside using the "walking bleach" technique.<sup>7</sup> In this technique, the inside of the pulp chamber is cleaned of pulp debris, the gutta-percha is removed to 2 mm below the cemento-enamel junction, and a barrier (ie glass ionomer) is placed over the gutta-percha. Next, a bleaching medicament (ie hydrogen peroxide, sodium perborate, carbamide peroxide) is placed into the pulp chamber and the endodontic access is temporarily sealed. The "internal" bleaching material must be changed weekly, from one to six times, depending on the desired tooth color. The ADA code for "internal bleaching per tooth" is D9974. However, this process can lead to multiple dental visits and become time-consuming for both the patient and the provider. Because the process of internal bleaching can take from one to six visits, the amount of "meet, greet, and seat" time for the patient, as well as the treatment and



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FIG. 1



FIG. 2



FIG. 3

(1.) Bleaching only one arch demonstrates the change to the patient when the bleached maxillary arch is compared to the unbleached mandibular arch. (2.) A “single-tooth” bleaching tray allows the bleaching of one tooth without changing the color of the adjacent teeth until the final shade of the single tooth is determined. (3.) The inside of an endodontically-treated tooth must be opened sufficiently to remove pulp debris and any material that is causing discoloration. (4.) A pipe smoker of several years has intrinsic and extrinsic staining, which is very difficult to remove. (5.) Three months of nightly bleaching using 10% carbamide peroxide in a custom-fitted, non-scalloped, no-reservoir tray successfully removed the nicotine staining. *Figures 1, 4, and 5 were previously published in Haywood, VB. Tooth Whitening: Indications and outcomes of Nightguard Vital Bleaching. Chicago, IL: Quintessence; 2007 and reproduced with permission.*



FIG. 4



FIG. 5

cleanup time, can make it difficult to predict an appropriate fee for the process.

To ameliorate this concern, one approach is to combine both “internal” and “external” bleaching treatment. This time-efficient approach involves accessing the tooth internally to clean the pulp chamber, place the barrier, and add the bleaching medicament, as is done in the walking bleach technique (Figure 3); however, after this initial access, the bleaching process is continued from the outside in using a “single-tooth” bleaching tray. Although the

addition of “external” bleaching requires an alginate impression, cast, and tray, the time saved by allowing the patient to continue the treatment for as long as is needed at home without scheduling weekly chairtime to access the tooth and change the material offsets the cost. This allows the practice to be more time- and cost-efficient and allows the patient to spend less time traveling and visiting the office.

The challenge with the dual “inside and outside” bleaching approach is choosing the best procedure code and the most appropriate fee.

The dentist should consider selecting “single-tooth internal bleaching” (ie, D9974) for the code and fee because this treatment requires the most chairtime, and then include the cost of making the single-tooth external bleaching tray as a part of that fee without using a separate code. This approach is more time-efficient and profitable for the office than performing internal bleaching only. After the single-tooth bleaching is completed, which may take 8 to 10 weeks, wait 2 weeks for the shade to stabilize and then restore the access opening with a composite in a matching shade. If the single tooth does not fully bleach to match the adjacent teeth, then a lighter-shade composite should be used. Sometimes, a stark white, opaque composite material is placed into the most apical third of the access, followed by a matching shade composite in the anatomical area to close the orifice. This composite restoration requires a different code (ie, D2330) and an additional fee.

In the case of a single dark tooth that was previously endodontically treated but is adequately sealed with a composite, there is no need to reenter the pulp chamber in order to bleach if the cleanliness of the pulp chamber can be verified via a radiograph. The normal, “per-arch” bleaching tray code (ie, D9975) and fee should be applied regardless of whether a single-tooth bleaching tray or full-arch bleaching tray is used to bleach the tooth.

### Significant Extrinsic and Intrinsic Staining

The extended treatment of nicotine- and tetracycline-stained teeth requires an approach involving a modified fee. Nicotine-stained teeth (Figure 4) require 1 to 3 months of nightly treatment with 10% carbamide peroxide to remove the soaked-in nicotine stains (Figure 5). Tetracycline-stained teeth can require 2 to 12 months of nightly treatment (ie, 3 to 4 months on average) for the bleaching material to enter the dentin and remove most of the tetracycline staining (Figure 6 and Figure 7). Due to these unpredictable treatment times, the determination of a fair fee for both the dental office and the patient is best achieved by creating a “pay-as-you-go” process. The patient pays the normal single-arch bleaching fee using code D9975 and is provided with roughly enough material to bleach one arch for 1 month. During this time, the patient uses a form to record their nights of treatment to determine exactly how long the initially dispensed syringes will last,

which in turn, determines how often the patient will require a refill. The fee for the extended treatment becomes the cost of the materials used per month plus any chairtime needed until the desired shade is reached. The dental office can charge accordingly for the purchase of subsequent bleaching refill kits. Because the treatment time can vary greatly based on each patient's situation, this method of calculating payment is fair to both the patient and to the dental office. It also allows flexibility for the patient to bleach to the point when the shade stabilizes without further change or to the point when he or she is pleased with the result, tires of the procedure, or no longer wishes to spend further finances on bleaching.

### Existing Decay Considerations

When considering bleaching in cases involving existing decay, the treatment may require two different codes and fees. The final shade achieved and the rate of shade change from bleaching is different for every patient. If the patient is interested in bleaching and presents with existing decay that requires a restoration, the dentist cannot reliably predict the final shade of the restoration prior to bleaching. Fortunately, bleaching with 10% carbamide peroxide stops the progression of decay while the bleaching treatment is in process.<sup>8,9</sup> With most small carious lesions, the dentist can bleach over the existing decay (Figure 8 and Figure 9), wait 2 weeks for the shade to stabilize and the bond strengths to return to normal, then restore the lesion with the appropriate shade of composite.

However, if the decay is deep or the tooth is sensitive, the caries needs to be removed prior to bleaching to avoid further pulpal insult (Figure 10). In these cases, the dentist can first place a "protective restoration" (ie, code D2940) with a resin-modified glass ionomer (RMGI), selecting the best possible projection of the final shade (Figure 11). With this protective restoration placed, the patient can then bleach his or her teeth while also minimizing the concern of a pulpal insult or further progression of caries if he or she unexpectedly stops bleaching. If the esthetics of the RMGI need improvement during the bleaching process, a thin layer of resin infiltrate (eg, Optiguard™ Surface Sealant, Kerr™) can be added to the surface of the restoration to create a glossy and natural appearance (Figure 12 and Figure 13). Upon completion of the bleaching treatment, if the shade of

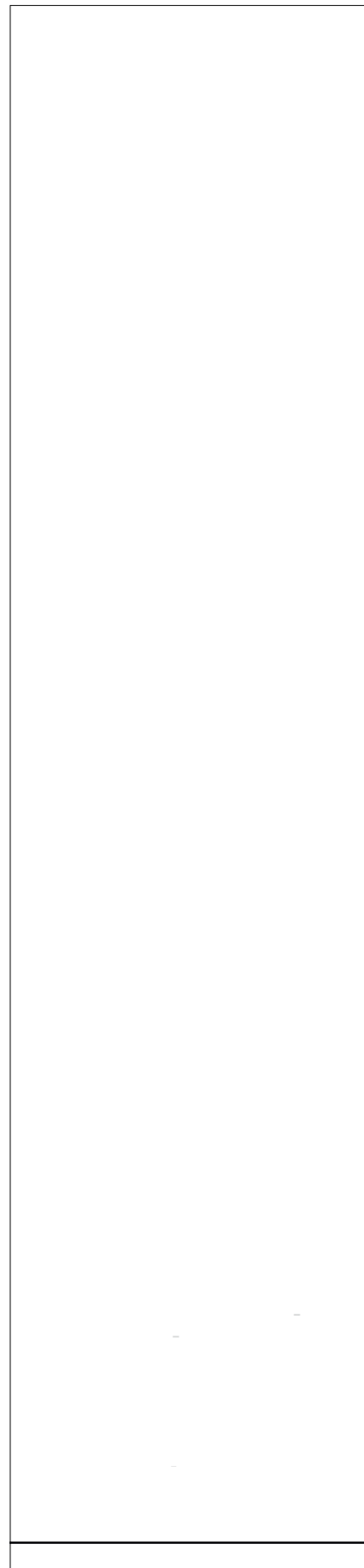
the RMGI matches reasonably well, and the patient is satisfied with the appearance, then no further treatment is needed. However, if the final bleaching shade does not match the previously placed RMGI, or the surface gloss is insufficient, then the dentist need only remove the external portion of the RMGI and bond an appropriate shade of composite, leaving the remaining RMGI as a base. Although this additional treatment provides the best esthetics and the safest option for deep decay or sensitive lesions, it requires a separate fee and code for the final resin-based composite restoration (ie, D2332).

### Thermoplastic Trays

For the maxillary arch, the use of thermoplastic trays<sup>10</sup> can facilitate a reduced fee for patients who require only minimal lightening or who have difficulty with the process of making impressions (Figure 14). Teenagers and young adults often have reasonably white teeth but may still have a desire to maximize their tooth shade.<sup>11</sup> As opposed to pursuing over-the-counter products,<sup>12</sup> it is best for the dentist to provide a proper examination and radiographs to determine a diagnosis for any discoloration.<sup>13</sup> Fabrication of a thermoplastic tray can be accomplished in a few minutes and bypasses the need for alginate impressions, casts, and a vacuum former. Although the standard single-arch bleaching code is still used, the associated fee can be reasonably reduced because this approach requires less chairtime, no laboratory work, and no impression material. This can provide an excellent way to help some patients achieve their desired level of esthetics without needing to charge the full fee for the traditional bleaching impression/cast. This approach works best on the maxillary arch due to the tongue's position when swallowing to form the tray. This normal swallowing benefit is not present when attempting a mandibular thermoplastic tray, so the mandibular arch will usually require a traditional impression and tray with a different fee. Just as with traditional, single-arch bleaching, completing one arch at a time is inherently less expensive and can provide the patient with visible results to later determine whether or not bleaching the mandibular arch is desired.

### Orthodontic Considerations

The occurrence of white spot lesions and caries from improper oral hygiene during orthodontic treatment can be significantly







**(6.)** Tetracycline staining occurs deep in the dentin and is the most difficult stain to remove. **(7.)** Tetracycline-stained teeth after 7 months of nightly bleaching treatment with 10% carbamide peroxide in a non-scalloped, no-reservoir, custom tray. **(8.)** Patient with minimal decay that does not need to be restored prior to bleaching because the final shade cannot be determined in advance. **(9.)** After bleaching over minimal decay, the proper shade can be selected, and the tooth can be restored. **(10.)** A patient with extensive decay that elicits concerns regarding pulpal involvement as well as the restorability of the tooth needs some type of protective restoration prior to the initiation of bleaching. **(11.)** The caries is removed, and a protective restoration is placed to allow for further bleaching without concern for the advancement of decay if the patient stops bleaching. **(12.)** A provisional canine restoration made from bis-Acryl does not exhibit the gloss of the adjacent fixed partial denture or teeth. **(13.)** Placing a composite sealer provides more natural gloss while bleaching is being completed. *Figures 6 and 7 were previously published in Haywood, VB. Tooth Whitening: Indications and outcomes of Night-guard Vital Bleaching. Chicago, IL: Quintessence; 2007 and reproduced with permission.*

reduced by utilizing bleaching materials.<sup>14</sup> Although this approach requires adding an additional fee to that of the orthodontic treatment, the benefits of bleaching while the patient is in an orthodontic appliance can greatly reduce the need for and cost of restorative treatment after the completion of orthodontic therapy. This preventive approach is highly effective because in addition to bleaching the teeth, the bleaching material helps to cleanse the teeth and gingiva from bacteria and plaque during orthodontic treatment. Considering the ease of use, cost-effectiveness, and minimal chairtime required, thermoplastic material is ideal for making bleaching trays that fit over orthodontic brackets intraorally (Figure 15). These trays help to fend off white spot lesions and decalcification by elevating the intraoral pH, removing plaque, and killing some of the bacteria that cause tooth decay. As the teeth continue to shift during orthodontic treatment, new trays will need to be fabricated approximately every 2 to 3 months, which can add about \$400 to \$800 to the total treatment costs over a 2-year treatment period. The attraction of this approach is twofold. First, the young patients undergoing orthodontic therapy are motivated to wear the tray because they are bleaching their teeth, and second, the parents are receiving value in their investment via improved hygiene and a reduction in white spot lesions or caries, which subsequently reduces the potential need for costly future restorations that could range from \$175 to \$250 per tooth. Furthermore, the thermoplastic trays can be made directly over the orthodontic brackets in the mouth and can also serve as a “sports guard” to minimize bracket damage to the lips and cheeks. The only segment of orthodontics for which this treatment does not apply is when the patient is in cross-elastics. For these patients, injecting 10% carbamide peroxide directly onto the brackets will afford some hygienic benefits, as will using a water pick with a 1:1 ratio of water and 3% hydrogen peroxide (Figure 16). In addition, an over-the-counter, 10% carbamide peroxide oral antiseptic supplementary product (eg, Gly-Oxide® Liquid Antiseptic Oral Cleanser, GlaxoSmithKline) can be injected directly onto the teeth and tongue for a 2- to 3-minute cleaning rinse. This product is also used to disinfect and deodorize bleaching trays and many other appliances (eg, occlusal guards, oral sleep appliances). Moreover, the manufacturer recommends placing it



(14.) An example of a thermoplastic tray that can be softened with hot water and formed directly in the mouth without making an alginate impression and cast. (15.) Thermoplastic tray fabricated directly in the mouth and over the braces with no need to remove the arch wires. (16.) Gly-Oxide, which has a bubbling, foaming action, is injected into the brackets as an adjunct to oral hygiene procedures. (17.) Custom tray used with 10% carbamide peroxide and worn nightly for caries control in elderly patients. (18.) Patient injects 10% carbamide peroxide into an area that is difficult to clean with conventional methods.



on toothbrushes prior to the toothpaste as an adjunct to improve overall oral hygiene. Although Gly-Oxide was the original bleaching material, it is too runny for tray bleaching and does not stay on teeth for long periods; therefore, thicker, more viscous materials are indicated for tray use to achieve longer lasting benefits.

### Caries Control

One adjunct to routine caries control is the use of carbamide peroxide with custom trays. This approach can be especially helpful in elderly patients with dry mouth (Figure 17) or who experience reduced salivary flow from radiation therapy. Treatment to control caries with bleaching products should not be given bleeding codes. The appropriate code to use for the tray would be for a “fluoride gel carrier,”

which is D5986, and the appropriate code to use for the material is for “drugs or medications dispensed in the office for home use,” which is D9630. Bleaching products containing urea, such as carbamide peroxide, elevate the pH of the mouth, which stops or slows the process of tooth decay. This change in pH occurs within 5 minutes of tray insertion,<sup>15,16</sup> and the pH remains elevated while the trays are in the mouth. In addition, carbamide peroxide has been shown to kill the bacteria that cause caries.<sup>17</sup> Accordingly, the bleaching process effectively removes the salivary film and plaque layer from the teeth, leading to environmental control and a reduction in caries. The challenge associated with this approach to caries control is the ongoing cost of the 10% carbamide peroxide. It can be supplied from the dental office in the same manner as it is