

Extended Bleaching of Tetracycline-Stained Teeth: A Case Report

Changing the color of tetracycline-stained teeth has always presented dentists with a difficult esthetic challenge. However, it has recently been shown that bleaching with 10% carbamide peroxide in a custom-fitted tray that is worn for an extended period produces various degrees of lightening on tetracycline-stained teeth.¹ This case report presents the successful results of treating a patient with tetracycline-stained teeth using the extended treatment time and the nightguard vital bleaching technique.

Case Report

A patient with moderate tetracycline-stained teeth expressed interest in conservative esthetic therapy. Because of the color of her stained teeth, the patient reported that she had never smiled openly enough to show her teeth in a photograph. Attempts to smile for preoperative photographs were strained (Figure 1). Tooth No. 9 had previously received endodontic therapy and had been restored with a composite restoration that included the mesial-incisal corner of the tooth (Figure 2).

The patient was treated using the conventional nightguard vital bleaching technique. An alginate impression of the maxillary arch was made, and a cast was poured from dental stone (Microstone®, Whip Mix® Corporation). The bleaching tray was fabricated using a soft tray material (Sof-Tray®, Ultradent Products, Inc.). Reservoirs 0.5 mm thick were placed on the facial aspects of the maxillary anterior teeth.² The vacuum-formed soft tray was then trimmed following the contours of the necks of the teeth in the conventional scalloped-reservoir design.

Ten-percent carbamide peroxide in a white creamy thixotropic base (Colgate® Platinum Professional Tooth-Whitening System, Colgate Oral Pharmaceuticals) was used for the nightguard vital bleaching. The patient was instructed to wear the Platinum-loaded tray overnight with the understanding that treatment would be continued until there was a successful outcome or at least 2 to 3 months had passed with no evident color change. Although the original instructions for the Platinum tooth-whitening material described a bleaching schedule of 1 to 2 hours during the day, a recent abstract had shown that more than 60% of this bleaching material is still active and present in the tray after 4 hours in the mouth.³ Another report also indicated continued activity of this product at 4 hours.⁴ Therefore, patients may obtain better whitening for a given amount of material if they are able to wear the tray all night.

Because the Colgate® Platinum Professional Tooth-Whitening Material is a whitish color, the presence of the material is easily observable in the clear tray. Patients can see when they have an adequate amount of material covering the teeth, and adjust the amount applied accordingly to avoid waste. Several applications per tube are possible, depending on arch size and reservoir size.

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At the 1-month recall, the whitening had begun at the incisal edge of the teeth and was progressing toward the gingival third (Figure 3). Bleaching of tetracycline-stained teeth is a very slow process, and patients should be willing to continue with treatment for at least 2 months before deciding whether any significant color change can be seen on their teeth.⁵

The patient was pleased with the initial progress and wanted to continue treatment. An example of the further progress is shown at the 7-month recall, where the whitening had progressed more apically on the tooth toward the gingival third (Figure 4). The gingival third is the most difficult part of the tooth to whiten, partly because of the thinness of the enamel, the composition of the dentin, and the thickness of both the dentin and the tooth in that area, as well as the difficulty in maintaining contact of the bleaching material with the neck of the tooth in the scalloped-reservoir tray design. Because of the difficulty with lightening the gingival third and the water solubility of the bleaching material being used, the tray design was changed to a nonscalloped, no-reservoir design (Figure 5). In this example, the tray was fabricated without the reservoirs, and the soft tray material was vacuum-formed tightly around the teeth. On insertion, the fit of the tray was evaluated to make sure that there was no blanching of the tissue, no rough edges, and no perceivable pressure applied to the teeth. Because the Platinum material is thixotropic, it will flow under pressure to a very thin layer. As can be seen in Figure 5, there is still adequate material covering the teeth for bleaching.

The nonscalloped, no-reservoir tray design is the original bleaching tray design, which much research has shown to be very effective in bleaching.⁶ There is no indication that the presence or absence of a reservoir-type spacer or similar foam insert has any effect on bleaching time.⁷ The primary functions of the reservoir are to allow seating of the tray when loaded with very viscous material, and to remove pressure from the teeth to reduce sensitivity. It has also been shown that a more fluid material is retained in the tray for a longer period with trays that contact the tissue because there is a better seal between the gingival portion of the tooth and the tray (Dr. Ron Lemon, American Dental Association Peroxide-Containing Materials Workshop, 1993). Bleaching materials that are very thick and sticky do not require a tight tissue seal; however, materials that are more water soluble and less viscous may benefit from having a sealed environment. This sealed environment also holds the bleaching agent against the neck of the tooth, supplying material to the challenging area of the gingival third.

After approximately 12 months of patient treatment, consisting of wearing the nightguard every night during sleep, a color change was no longer evident between appointments. It was assumed that the vital teeth were whitened to the best color that could be obtained (Figure 6). This is an acceptable goal and endpoint for patients with tetracycline-stained

teeth. However, the nonvital tooth still had a slightly yellow appearance, partly because of the older, discolored composite in the pulp chamber. Treatment then focused on the nonvital tooth to see if a level of whitening that matched the vital teeth could be obtained.

First, the old composite restorative material was removed from the pulp chamber and the root canal area to a point 2 mm below the dentinoenamel junction (Figure 7). For this patient, an in-office bleaching technique was attempted, using a light-activated 35% hydrogen peroxide (Hi Lite, Shofu® Dental Corporation). In the interest of conserving office chair-time, a composite curing light was used to activate the peroxide as per the manufacturer's instructions (Figure 8). A slight degree of lightening was observed, but not as much as desired. The primary color change was effected by placing a white composite core into the pulp chamber after etching, priming, and bonding to the dentin. A conventional hybrid composite restorative material (Herculite® XRV™, dentin color, KERR® Corp.) was used to fill the orifice and replace the incisal corner.

After restoring the tooth with the composite restoration, the final outcome of whitening and restoration of the patient's teeth could be seen at the 13-month recall (Figure 9). The patient had a much more attractive maxillary arch, and found it was more natural to smile fully (Figure 10) compared to the strained smile at the beginning of treatment (Figure 1). The patient reported that she had had photographs taken since completing the bleaching, and for the first time in her life, she smiled enough to show her teeth in the photograph.

Discussion

Nightguard vital bleaching with 10% carbamide peroxide has been shown to be a viable treatment option for lightening mild to moderate tetracycline-stained

teeth. In the case presented, the treatment was performed only in the maxillary arch. This is a very strategic treatment approach, because one of the disadvantages of home bleaching is patient compliance. The dentist cannot force the patient to comply with regular daily/nightly treatment. Patients

tend to comply better with treatment if they are encouraged by seeing the color change between the top and bottom teeth. Therefore, with treatment that may take several weeks or months, it is helpful to treat only one arch at a time, and use the other arch as a control or means of encourage-

ment for the patient.

When patients have completed treatment on one arch, they can proceed with the other arch. Interestingly, approximately 50% of patients with discoloration who have bleached the maxillary arch elect not to treat the mandibular arch. The reason given is that the

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mandibular arch “does not show” when they smile. This observation has been consistent even in research projects where there is no cost for the additional treatment. With severe staining, such as that seen with tetracycline-stained teeth, more patients do want to treat their mandibular discol-

oration. However, even these patients typically elect not to treat the mandibular arch for as long as the maxillary arch because they do not require the same degree of success that they were seeking with the maxillary arch. They desire only to have the mandibular teeth light enough to blend with

the maxillary teeth.

Besides compliance, the other area that may present difficulty with any kind of bleaching is tooth sensitivity. There are no predictors for determining whether a patient will experience sensitivity.⁸ Patients may indicate that they have a history of sensitive teeth

(ie, they cannot drink iced tea or eat ice cream), in which case it is more probable that they will experience sensitivity during bleaching. Sensitivity may also depend on treatment frequency. If patients apply the bleaching material more than once a day or if they use a higher concentration, they have a greater chance of experiencing tooth sensitivity. Double-blind clinical research has also demonstrated that about one quarter to one third of patients using the placebo material (without the peroxide) experience sensitivity.⁹

Dentists need to be aware of the various options for treating patient sensitivity. Either a passive or active approach can be used. A passive approach would include skipping a night so that bleaching is performed every other night, using a shorter treatment time—several hours during the day rather than all night long, or stopping treatment for a few days and then starting again. Often, cessation of treatment for a few days and then re-initiation reduces the occurrence of any additional sensitivity. If a patient presents with a history of sensitive teeth, a slower treatment process could be used. Some practitioners use a bleaching schedule of 1 hour a day for the first week, followed by 2 hours a day during the second week, thereby gradually working up to an all-night treatment schedule. Other practitioners may start the patient out with a low-concentration bleaching material and increase the concentration as the patient gets used to the bleaching sensation. The passive approach involves titration of application frequency and duration, as well as the choice of material concentration.

The active approach involves the application of a medicament to sensitive teeth. The first generation of desensitizers used with bleaching were the fluorides. Neutral fluoride material can be applied via the tray. Patients can either alternate the use of the bleaching material and the fluo-

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Figure 1—The patient's pretreatment smile was very strained because she normally never smiled enough to reveal her teeth.



Figure 2—Pretreatment photograph of moderate tetracycline-stained teeth with Vita® shade guide. Tooth No. 9 has undergone endodontic therapy.



Figure 3—Initial lightening of the teeth at the incisal third could be seen at the 1-month recall after nightly treatment with 10% carbamide peroxide (Platinum Professional Tooth-Whitening Material, Colgate Oral Pharmaceuticals).



Figure 4—The whitening had progressed farther up the tooth toward the gingival third at the 7-month recall.



Figure 5—The tray was changed to a nonscalloped, no-reservoir design at 7 months because of difficulty in lightening the gingival third.



Figure 6—At the 12-month recall, it was determined that no more lightening of the vital teeth could be achieved.

ride material every other night, or they can use the fluoride material during the day and the bleaching material at night. A 5% concentration of potassium nitrate has also been used as a desensitizing agent. Potassium nitrate is found in many desensitizing toothpastes. The potassium nitrate acts by stopping the nerve from repolarizing after the initial firing, which breaks the pain cycle. There are reports of its success after periodontal surgery by using potassium-nitrate containing toothpastes such as Sensodyne® (Block Drug Corporation) and Denquel (Richardson-Vicks, no longer available) in a bleaching-style tray.¹⁰ Brushing alone with potassium nitrate may take days or weeks to control the sensitivity,¹¹ whereas a reduction in sensitivity may be seen immediately after 10- to 30-minutes' application of the potassium nitrate in the tray. In the case presented, the patient experienced sensitivity in the first 3 months. Sensitivity was successfully treated by changing to a toothpaste containing 5% potassium nitrate for normal brushing. The patient did not need to progress to appli-

cation of the potassium nitrate with the tray.

Six to 12 months of treatment may seem to be a long treatment regimen to the dentist, but is not in the eyes of a patient who wants

very conservative treatment. Patients view it much like a weight-loss or muscle-building program; they do not need instant results, just some results that over time will lead to achieving the objec-

tive. The patient in this case report, as well as other similarly treated patients, have all been happy with the results of the technique and would recommend it to a friend with a similar problem.¹²



Figure 7—The old, discolored composite is removed from the pulp chamber of the nonvital tooth No. 9.



Figure 9—After etching, priming, and bonding to the dentin, a white composite core was placed in the pulp chamber to give the tooth a white inner color. A conventional hybrid restorative material was used to fill the orifice and replace the incisal corner of tooth No. 9.



Figure 8—A 35% light-activated hydrogen peroxide is applied to attempt further in-office lightening, but with little success.



Figure 10—After 12 months of whitening and replacement of the composite, the patient demonstrates a much more natural smile at the 13-month recall.

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At this point, the longevity of this technique is unknown, although stable color has been seen on 84% of the teeth treated at the 1-year recall. Routine touch-ups are not recommended unless a color regression is obvious. However, if patients' teeth discolor over time, they can return to the dentist with their bleaching trays to evaluate the fit of the tray, as well as to determine if there are any causes for the discoloration other than the tooth color regression. The nightguard vital bleaching process can then be re-initiated.

One of the revolutionary concepts that has been affirmed from the technique of bleaching tetracycline-stained teeth is the fact that dentists are changing the color of not just enamel, but also the dentin.¹³ Tetracycline is tightly bound up inside the dentin. This binding makes the discoloration difficult to access and remove, but it is achievable if given enough time. Dentists need to inform patients that the process of whitening teeth may take longer than the manufacturer's suggested treatment time. With nontetracycline-stained teeth, the average treatment time for most patients is 2 weeks. However, for some patients, the bleaching process takes only 1 to 2 days, while for others it takes as long as 3 to 6 weeks. When lightening tetracycline-stained teeth, patients need to be committed to continuing treatment for at least 2 months, and, preferably, treat for 6 months if lifestyle commitment and sensitivity factors can be managed. The advantage of home bleaching over laser- or other power-bleaching techniques is that once the bleaching tray is fabricated and the patient is on a routine recall system, there are no additional high fees or added expenses for the patient or the dentist. After the patient starts treatment, the only additional costs incurred are those for materials and continued monitoring. Monthly recalls are adequate for this extended treatment.

Another concern with the bleaching of tetracycline-stained teeth for an extended period is the effect on the tooth structure. However, previous research has been published on the use of a 10% carbamide peroxide material in a syringe-delivery system (Opalescence® Whitening Material,

Ultra-dent Products, Inc.) on tetracycline-stained teeth.¹ At the conclusion of 6 months of bleaching, with almost 1,000 hours average treatment time, impressions were taken of the teeth and epoxy dies were generated. Scanning electron microscopy at magnifications of X200 and X2,000 showed no dam-

age to the enamel from the extended bleaching time. There was no observable clinical or microscopic change in surface texture between the treated maxillary teeth and the untreated mandibular teeth. Several other articles report extended treatment times, including 3 months of treatment to remove nicotine

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stains (from pipe smoking) of 20 years' duration,¹⁴ as well as 4-, 6-, and 8-week treatment times for varying stains.¹⁵⁻¹⁸ The length of treatment depended on the type of stain, patient compliance, and how responsive the patient's teeth were to treatment.

Even when veneers are antici-

pated as restorative therapy on tetracycline-stained teeth, it may be beneficial to first try the bleaching procedure. In some cases, bleaching may work well enough to satisfy the patient's esthetic needs without the need for veneers. If veneers are still required after bleaching, the teeth

may be lighter and more lifelike translucent veneers can be placed than those required when trying to mask darkly stained teeth. Certainly, the cost of bleaching is minimal compared to what it would cost for veneers.

Predictors for the degree of whitening that can be obtained for

tetracycline-stained teeth are both the color of the tetracycline staining and the location of the stain. Blue-brown stains are not as easily removed as yellow-brown stains. Gray stains are the least responsive. Also, heavy staining located in the gingival third of the tooth has the poorest prognosis. When the staining is located primarily in the middle and incisal thirds of the tooth, a good outcome can be expected. Patients should be cautioned that their teeth will never be whitened to the degree where *they* cannot see they had tetracycline staining. However, significant lightening often can be obtained, which may be considered an esthetic success for the patient. Other techniques that combine in-office and home bleaching may offer a reduction in time. However, the color change may not be profound enough to warrant the increased cost to the patient.^{19,20}

Practice Application

Because it is unknown with each patient just how long the bleaching process will take or what kind of results will be obtained, it is difficult for dentists to establish an initial fee for the entire treatment. The best recommendation is to establish fees based on monthly recalls. Most bleaching kits contain enough material to bleach both arches for an average of approximately 2 weeks. Therefore, one kit could be used on one arch for approximately 1 month. Dentists can charge their initial bleaching fee for one kit, or a slightly higher fee to cover extra material, to start the process. Patients then begin with a 1-month supply of bleaching material. When they return for the monthly recall, their progress is determined. Dentists could charge an office visit fee plus the cost of material for an additional month's treatment. Dentists can ask their patients to record the number of applications per bleaching tube or syringe to determine the amount

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of material that the patient will need each month. From the first recall, the treatment will be continued for at least another month. At the 2-month recall, and each subsequent recall, the dentist and patient should discuss whether they are seeing continued tooth color changes. They should notice the discoloration retreating from the incisal to the gingival, and make a decision on whether treatment should be continued for another month. Dividing the tooth into thirds incisogingivally and recording the shade of each third may help document shade changes. If the patient chooses to continue treatment for another month, he or she can be given additional material and charged the fee for that and an office visit. If it is decided not to continue treatment, the final photographs are taken and a decision is made regarding treatment of the mandibular arch.

Products Used for Treatment

Published research and clinical articles have demonstrated success with at least two 10% carbamide peroxide materials (Colgate® Platinum Professional Tooth Whitening System and Opalescence® Whitening Material) for the treatment of tetracycline-stained teeth when applied as needed for 3 to 10 months.^{1,16} Adequate results should be achievable with any bleaching material that contains 10% carbamide peroxide or a higher concentration, used in a custom-fitted tray, with patient monitoring by a dentist, as long as the material has an adequate shelf life for the duration of the treatment. Patient compliance and management of sensitivity are important factors for success.

By using excellent home-bleaching products as described in this case report, the dental professional can now offer stable, safe, esthetically rewarding, financially achievable treatment for tetracycline-stained teeth. 

References

1. Haywood VB, Leonard RH, Dickinson GL: Efficacy of six-months nightguard vital bleaching of tetracycline-stained teeth. *J Esthet Dent* 9(1):13-19, 1997.
2. Haywood VB: Nightguard vital bleaching: construction of NGVB prosthetic. *Dent Today* 16(6):86-91, 1997.
3. Nathoo SA, Richter R, Smith SF, et al: Kinetics of carbamide peroxide degradation in bleaching trays. *J Dent Res* 75:286, 1996. Abstract.
4. Christensen GJ: Tooth bleaching, state-of-art '97. *CRA Newsletter* 21(4):1-3, 1997.
5. Haywood, VB: Bleaching tetracycline-stained teeth. *Esthet Dent Update* 7(1):25-26, 1996.
6. Haywood VB, Leonard RH, Nelson CF, et al: Effectiveness, side effects and long-term status of nightguard vital bleaching. *J Am Dent Assoc* 125(9):1219-1226, 1994.
7. Haywood VB, Leonard RH, Nelson CF: Efficacy of foam liner in 10% carbamide peroxide bleaching technique. *Quintessence Int* 24:663-666, 1993.
8. Leonard RH, Haywood VB, Phillips C: Risk factors for developing sensitivity and gingival irritation associated with nightguard vital bleaching. *Quintessence Int* 28:527-534, 1997.
9. Leonard RL, Bentley C, Phillips C, et al: ADA controlled clinical trial of a 10% carbamide peroxide solution. *J Dent Res* 76(2365):309, 1997.
10. Jerome CE: Acute care for unusual cases of dentinal hypersensitivity. *Quintessence Int* 10:715-716, 1995.
11. Silverman G, Berman E, Hanna CB, et al: Assessing the efficacy of three dentifrices in the treatment of dentinal hypersensitivity. *J Am Dent Assoc* 127:191-201, 1996.
12. Haywood VB, Leonard RH: Six and 12-month color stability after 6-months bleaching tetracycline teeth. *J Dent Res* 75:379, 1996. Abstract.
13. Haywood VB: Bleaching of vital teeth—current concepts. *Quintessence Int* 28(6):424-425, 1997.
14. Haywood VB, Robinson FG: Vital tooth bleaching with nightguard vital bleaching. *Current Opinion in Cosmetic Dentistry* 4:45-52, 1997.
15. Croll TP, Sasa IS: Carbamide peroxide bleaching of teeth with dentinogenesis imperfecta discoloration: report of a case. *Quintessence Int* 26:683-686, 1995.
16. Haywood VB: Historical development of whiteners, clinical safety and efficacy evaluation. *Dental Update* 24:98-104, 1997.
17. Sharma N, Galustians J, Curtis JP, et al: Two tooth-whitening systems containing 10% carbamide peroxide: a 7-month study. *J Dent Res* 75:46, 1996. Abstract.
18. Haywood, VB: Achieving, maintaining, and recovering successful tooth bleaching. *J Esthet Dent* 8(1):31-38, 1996.
19. Garber DA, Goldstein CE, Goldstein RE, et al: Dentist monitored bleaching: a combined approach. *Pract Periodontics Aesthet Dent* 3(2):22-26, 1991.
20. Weinberg SP: Bleaching tetracycline-stained teeth: a combined approach. *Dent Today* 16(8):56-59, 1997.

Product References

For more information on the products mentioned in this article, please see contact information below.

Product: Colgate® Platinum Professional Tooth-Whitening System
Manufacturer: Colgate Oral Pharmaceuticals
Address: 1 Colgate Way
 Canton, MA 02021
Phone: 800-821-2880
Fax: 617-828-7330

Product: Herculite® XRV™
Manufacturer: KERR® Corp
Address: 1717 West Collins Avenue
 Orange, CA 92867
Phone: 800-537-7123
Fax: 800-537-7345

Product: Hi Lite
Manufacturer: Shofu® Dental Corporation
Address: 4025 Bohannon Drive
 Menlo Park, CA 94025
Phone: 415-324-0085
Fax: 800-326-3180

Product: Microstone®
Manufacturer: Whip Mix® Corporation
Address: 361 Farmington Ave
 Louisville, KY 40217
Phone: 502-637-1451
Fax: 502-634-4512

Product: Sensodyne®
Manufacturer: Block Drug Corporation
Address: 257 Cornelison Avenue
 Jersey City, NJ 07302
Phone: 201-434-3000
Fax: 201-434-4990

Product: Sof-Tray®, Opalescence® Whitening Material
Manufacturer: Ultradent Products, Inc.
Address: 10200 South 505 West
 South Jordan, UT 84095
Phone: 800-689-5893
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