

At-Home Whitening and Selective Bonding of Tetracycline-Stained Teeth



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Tetracycline-stained teeth present an esthetic problem at traditionally has required aggressive and expensive restorative treatment to resolve. Even when using good restorative materials, the masking needs required for severely banded discolorations have often compromised the esthetic outcome. These cases often require aggressive preparation to achieve an esthetic restorative result. In-office whitening has not yet

become popular in the treatment of these teeth, as a result of the extensive number of visits that may be needed and the financial investment required—even before it can be determined that there may be a reasonable result.

In 1997, the first study was published that explored at-home whitening of tetracycline-stained teeth with 10% carbamide peroxide in a custom-fitted tray. The study found that, by extending the treatment time, an acceptable



Figure 1—At the initial examination, the tetracycline staining was located in the incisal one half to one third of the tooth, with malformed portions of the teeth present.



Figure 2—The enamel did not cover the dentin on the tips of the canines. This demonstrates how the color of the teeth is located in the dentin, and offers an excellent opportunity to see the dentin change color.



Figure 3—Although the facials of the teeth were covered with old bonding materials, a lingual view shows the dark banding in the middle third of the tooth.



Figure 4—The shade of the gingival portion of the tooth was A3, but the tetracycline portion was darker than C4.



Figure 5—A new type of tray system uses an outer blue tray to carry the thinner, softer inner white tray to the mouth to be custom molded by the dentist. The thin white inner tray, which is semi-rigid when cooled, is used to deliver the whitening material.



Figure 6—A 10% carbamide peroxide, Colgate Platinum *Overnight*TM, was used overnight in a nonreservoir, nonscalloped tray design.



Figure 7—After 2 months of nightly treatment, the teeth were beginning to lighten.



Figure 8—Examination of the exposed tetracycline-stained dentin on the canines revealed a lightening in color.

esthetic result could be obtained.¹ In the study, teeth were whitened for an average of approximately 1,000 hours over a 6-month period, with moderate-to-excellent results. Other reports have expanded on the knowledge,² fee structure,³ time frame for treatment,⁴ and duration of color change.⁵ In the authors' experiences, tetracycline-stained

teeth generally respond most favorably when whitened using 10% carbamide peroxide in a nightly tray delivery system for 2 to 6 months or longer. Although the tetracycline staining resides primarily in the dentin, it has been shown that both the dentin and enamel change color during whitening. The purpose of this case report is to offer a conserva-

tive option for treatment that uses both whitening and selective bonding of mal-formed, tetracycline-stained teeth. This treatment still leaves other more aggressive treatment options available, should they be needed.

CASE REPORT

A 35-year-old man presented with moderate-to-severe tetracy-



Figure 9—As the teeth got lighter, more of the excess composite was removed, revealing the heavy banding in the middle of the tooth.



Figure 10—At 4 months of treatment, more of the composite was removed as the bands became lighter.



Figure 11—After approximately 12 months of nightly treatment, the teeth were slightly lighter than B1, but a faint banding was still present.



Figure 12—At 12 months, most of the dentin discoloration had been removed as is seen in the canine, but a slight banding is still present.

cline staining in portions of his teeth, as well as malformed teeth and failing composite restorations (Figure 1). His dental history revealed high fever and the use of tetracycline as a young child. While he was in the third grade, the banded tetracycline stains were partially masked with composite veneers. Now, 25 years later, that early restorative treatment had begun to fail. The teeth had fully erupted, resulting in only partial coverage of the teeth by the composite veneers, and portions of the remaining



Figure 13—After 13 1/2 months of whitening and 2 weeks of color stabilization, the final whitening color was realized, which was still lighter than B1. The patient stopped whitening when he had gone 1 month with no obvious color change.



Figure 14—The canine dentin was only slightly discolored, and the banding faint. The composite remained on the central incisors.



Figure 15—Rubbing the facial of the tooth with an explorer identified the older composite bonding. The patient now began whitening the mandibular arch.



Figure 16—The remaining composite material was removed using a high-speed handpiece and carbide bur, cutting without water to help identify the composite resin.

composite veneers had debonded. The incisal edges of the canines were not covered with enamel (Figure 2). The tetracycline discoloration that had not been veneered was darker than C4 on a Vita™ shade guide (Vident™), and was located primarily in the incisal half of the teeth (Figure 3). There was also a distinctly darker band in the middle third of the teeth. The gingival area of the

anterior teeth remained unaffected, and appeared to be approximately a shade A3 (Figure 4).

Previous papers have cited a poor prognosis for attempts to whiten tetracycline-stained teeth with dark gray banding, but a lack of discoloration in the gingival area improves the prognosis.⁶ Tetracycline-stained teeth with the best prognosis for whitening

are those discolored primarily at the incisal third, rather than the gingival third.⁶ A periapical radiograph was taken of the anterior teeth to determine that no periapical pathology existed. A rubber cup prophylaxis was also performed to eliminate any surface staining. The patient's desire was for white teeth, but he stated, "If they get lighter, I will be

happy." The decision was made to attempt at-home whitening with a 10% carbamide peroxide for an extended length of time to evaluate the feasibility of conservative treatment. The previous composite veneers would be progressively removed during whitening, with the possibility that little or no new composite restorations would be needed.



Figure 17—A dentin shade of B1 composite (Herculite® XRV™) was used to mask most of the banding on the central incisors.



Figure 18—The tips of the canines were etched, primed, and bonded with the same shade, completing the smile.



Figure 19—A closer view of the canine and central incisor demonstrates a reasonable masking. More variations in composite, such as opacity and minor shade steps above B1, would be helpful.



Figure 20—The final smile is much improved from the baseline. The patient also shaved his moustache, to show off his new smile.

However, the condition of the teeth underneath the existing composite bonding was still unknown.

The Tooth-Whitening Process

A novel tray system was used as part of an ongoing clinical study.⁷ This Dual Tray System (ArchTek, Inc.) makes possible the fabrication of a custom-fitted whitening tray in the dental office without the use of an alginate impression. Using this system allows the patient to begin the treatment immediately. The tray was fabricated in approximately 5 minutes (Figure 5). In this specific case, the tray remained serviceable for about 2 months with nightly use. Generally, occlusion wore a hole in the tray in that time frame, and another tray was fabricated. A more detailed description of this tray system and instructions can be found in another article,⁸ or on the manufacturer's website (www.archtekinc.com).

Colgate Platinum Overnight™ (Colgate Oral Pharmaceuticals), an American Dental Association (ADA)-approved 10% carbamide peroxide whitening material, was used for whitening (Figure 6). Other 10% ADA-approved carbamide peroxide products that may have been used instead are Opalescence® 10% (Ultradent Products, Inc.), Rembrandt® Classic 10% (Den-Mat Corp.), Nite White® Classic 10% (Discus Dental), and Patterson Tooth Whitening Gel 10% (Patterson Dental). Colgate Platinum Overnight™ is supplied in a syringe delivery system containing 10% carbamide peroxide in a water-soluble toothpaste-

type base. This material works well without any reservoirs or scalloping of the tray.⁹ The thermoplastic tray system used creates a nonreservoir tray of a single size. While the tray can be scalloped initially or later in treatment, there was no gingival irritation in this case. Therefore, scalloping was not necessary. The arch size of this patient allowed for complete coverage of the teeth. There had been some question as to whether the tray had to cover the entire tooth to be effective, but clinical and laboratory evidence indicates that a tray that extends to within 1 mm to 2 mm of the soft tissue will not alter the whitening outcome.¹⁰

The patient applied the 10% carbamide peroxide nightly and returned for recalls at 2-month intervals (Figures 7 and 8). Photographs were taken at each 2-month recall appointment, and a determination was made as to whether there was any additional color change. After the initial appointments determined that the teeth would lighten, portions of the composite restorations were removed at each subsequent visit (Figure 9). This progressive removal kept the dark banding less noticeable as the teeth lightened (Figure 10). The treatment continued until all the excess material beyond the normal contours of the teeth was removed, leaving only composite resin in the banded areas.

The patient had reported a history of sensitive teeth to cold drinks preoperatively. He experienced some sensitivity during treatment, for which he was given potassium nitrate to be applied in

the tray.¹¹ (The primary agent used in desensitizing toothpaste, or applied in the tray for the treatment of sensitivity during extended whitening, is 3% to 5% potassium nitrate.) He found that using the potassium nitrate for 30 minutes after each whitening treatment was sufficient to allow him to continue treatment. Another option for the management of tooth sensitivity during whitening, rather than by chemical means, is to skip a night of whitening treatment, or to wear the tray for a shorter length of time per day. About every 2 weeks, the patient skipped a night of whitening treatment. He continued whitening the maxillary arch until a month of treatment produced no further color changes (Figures 11 and 12). Total whitening time was 13 1/2 months of nightly wear, and the patient used approximately 66 syringes of Colgate Platinum Overnight™ (Figures 13 and 14). The final shade was lighter than B1, compared to the original shade that had been darker than C4.

The whitening was not able to totally eradicate the banding in the middle of the teeth, but the band did lighten significantly (Figure 15). After removing the remaining composite from the central incisors, it was determined that a partial composite restoration was needed (Figure 16). The generally accepted time period to wait after whitening and before composite bonding is 2 weeks. This time period allows the shade to stabilize for a proper matching of the composite shade, and allows the composite-to-enamel bond to have the maximum bond strength. Dentin

shade of Herculite® XRV™ B1 (Kerr Corp.) was used to cover the banding (Figures 17 and 18). Ideally, an ultralight shade of composite would have been used,¹² but one could not be found at that time that would match the tooth shade. Hopefully, manufacturers will continue to introduce more shades that are lighter than B1 in smaller incremental color changes, and in both opaque and translucent formulations (Figure 19).

The patient considered the final result to be very good (Figure 20). More noticeable than the teeth was the positive change in the patient's appearance. The modest fee for the whitening and bonding procedure gave this treatment an excellent cost/benefit ratio for the patient. In the authors' opinions, at-home whitening should be attempted on tetracycline-stained teeth, rather than proceeding directly to bonding or veneers, for a number of reasons. First, the most cost-efficient, least invasive technique is attempted, which is in the best interest of the patient. Second, if the whitening is successful, there is no need for further restorative treatment, so the patient will not require replacement restorations over time. Third, if the whitening is only partially successful, the other options are still available, and will generally be aided by having lightened the underlying tooth structure before veneering. Hence, should the patient desire even better esthetic results after at-home tooth whitening, porcelain veneers can be placed at that time. In patients with similarly stained teeth, whitening before

placing porcelain veneers is beneficial because the veneers can be fabricated with more translucency and a more lifelike appearance. Although the color change achieved by whitening is relatively stable, should the tooth color regress under veneers or existing composite bonding over time, the tooth can be relightened via whitening from the lingual surface.¹³

CONCLUSION

A conservative treatment option has been presented for tetracycline-stained teeth with banding and incomplete formation. This approach allows the patient to invest a minimal cost, and preserve a maximum amount of tooth structure. It requires a commitment from the patient for a longer treatment time than conventional whiten-

ing or restorative techniques. However, it prepares the teeth for further treatment if desired, and gives the patient an indication of how his or her teeth could appear if further treatment is indicated. Whitening and selective bonding is an excellent option to preserve the maximum amount of tooth structure while obtaining a reasonable esthetic outcome at a minimal fee. ○

C O N T I N U I N G E D U C A T I O N Q U I Z

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1. In the authors' experiences, tetracycline-stained teeth generally respond most favorably when whitened using 10% carbamide peroxide in a night- ly tray delivery system for:

- a. 2 to 6 days.
- b. 2 to 6 weeks.
- c. 2 to 6 months or longer.
- d. 2 to 6 years or longer.

2. What changes color during whitening?

- a. enamel only
- b. dentin only
- c. dentin and enamel
- d. the surface of the enamel only

3. Tetracycline-stained teeth with the best prognosis for whitening are:

- a. discolored primarily at the gingival third.
- b. discolored primarily at the

incisal third.

- c. discolored by banding.
- d. those with blue-gray discolorations.

4. In this specific case, the tray remained serviceable for how long with nightly use?

- a. 2 days
- b. 2 weeks
- c. 2 months
- d. 12 months

5. The primary agent applied in the tray for the treatment of sensitivity during extended whitening is:

- a. carbamide peroxide.
- b. potassium nitrate.
- c. sodium fluoride.
- d. hydrogen peroxide.

6. Another option for management of tooth sensitivity during whitening, rather than by chemical means, is:

- a. to use a higher concentration of carbamide peroxide.
- b. to skip a night of whitening treatment.
- c. to wear the tray for longer times per application.
- d. to wear the tray during the day as well as the night.

7. The generally accepted time period to wait after whitening and before composite bonding is:

- a. 24 hours.
- b. 2 days.
- c. 2 weeks.
- d. 2 months.

8. Referring to question 7 above, what does this time period

allow?

- a. it allows the tooth shade to stabilize for a proper matching of the composite shade
- b. it allows the composite-to-enamel bond to have the maximum bond strength
- c. it ensures no further buildup of the salivary pellicle
- d. both a and b

9. In the authors' opinions, why should at-home whitening be attempted on tetracycline-stained teeth, rather than proceeding directly to bonding or veneers?

- a. the most cost-efficient, least invasive technique is attempted
- b. if the whitening is successful, there is no need for further restorative treatment
- c. if the whitening is only partially successful, the other options are still available
- d. all of the above

10. What can be done, should the tooth color regress under the veneers or existing composite bonding over time?

- a. the teeth cannot be rewhitened if the color relapses
- b. the teeth can be relightened via whitening from the lingual surface
- c. the color of the teeth does not affect the color of the bonding or veneers
- d. the veneers or existing composite bonding must be removed to relighten the teeth via whitening

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Product References

Product: Vita™ shade guide

Manufacturer: Vident™

Address: 3150 East Birch Street, Brea, CA 92621

Phone: 800.828.3839

Fax: 800.848.2726

Product: Dual Tray System

Manufacturer: ArchTek, Inc.

Address: P.O. Box 1305, Golden, CO 80402

Phone: 800.356.9026

Fax: 800.382.6789

Product: Colgate Platinum Overnight™

Manufacturer: Colgate Oral Pharmaceuticals

Address: 1 Colgate Way, Canton, MA 02021

Phone: 800.821.2880

Fax: 617.828.7330

Product: Opalescence® 10%

Manufacturer: Ultradent Products, Inc.

Address: 505 W 10200 S, South Jordan, UT 84095

Phone: 800.552.5512

Fax: 801.572.0600

Product: Rembrandt® Classic 10%

Manufacturer: Den-Mat Corp.

Address: PO Box 1729, Santa Maria, CA 93456

Phone: 800.433.6628

Fax: 805.922.6933

Product: Nite White® Classic 10%

Manufacturer: Discus Dental, Inc.

Address: 8550 Higuera St, Culver City, CA 90232

Phone: 800.422.9448

Fax: 310.845.1537

Product: Patterson Tooth Whitening Gel 10%

Manufacturer: Patterson Dental

Address: 031 Mendota Heights Rd, St. Paul, MN 55120

Phone: 800.328.5536

Fax: 651.686.9331

Product: Herculite® XRV™ B1

Manufacturer: Kerr Corporation

Address: 1717 West Collins Avenue, Orange, CA 92867

Phone: 800.537.7123

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