

CONTINUING EDUCATION **XX**

INCORPORATING FLOWABLE COMPOSITES INTO THE MINIMALLY INVASIVE TREATMENT SEQUENCE FOR AESTHETIC ENHANCEMENT

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The conservative correction of stained anterior dentition is well-suited to minimally invasive techniques that first incorporate in-office, light-activated bleaching, and take-home, dentist-monitored tray bleaching. The second most conservative approach is the placement of direct composite restoratives, including recently introduced flowable varieties that help the clinician more precisely and predictably place these materials. This article demonstrates a conservative treatment sequence for in-office bleaching and direct composite placement for the aesthetic correction of discolored anterior maxillary dentition.

Learning Objectives:

This article discusses the use of bleaching and flowable composites for correcting tooth discoloration in the anterior maxilla. Upon reading this article, the reader should:

- Understand the importance of utilizing minimally invasive techniques to achieve patients' aesthetic goals.
- Recognize that a treatment sequence incorporating tooth bleaching and direct composites can be successful for whitening stained teeth.

Key Words: staining, composites, minimal intervention, bleaching

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Whether utilized for the replacement of worn or cavitated enamel or dentin, or for the correction of aesthetically displeasing form or color, restorative procedures are now guided by principles of minimal intervention that dictate the manner in which treatments are planned and restorative materials are selected and placed.¹ Aesthetic enhancement of intrinsically stained anterior dentition—in which no other disease is present—represents a treatment situation that can be approached with minimally invasive techniques.

Intrinsic staining of the dentition manifests following naturally occurring processes (eg, aging, disease, trauma).^{2,4} Dentition with intrinsic stains have responded favorably to whitening treatments of varying durations with peroxide agents.^{2,5,8} Alternative approaches to correct the appearance of stained dentition include placement of all-ceramic veneers or full-coverage crown restorations, in addition to placement of direct composite resins.⁴ Bleaching teeth prior to the placement of porcelain laminate veneers has also been advocated.^{4,8} Based on minimally invasive techniques, air-abrasion has also been promoted in literature as a useful alternative for the removal of extrinsic stains.⁹

Conservative correction of the stained anterior dentition would be well suited to minimally invasive techniques that first incorporate in-office, light-activated bleaching (eg, GC TiOn In-Office Tooth Whitening System, GC America, Alsip, IL; Zoom, Discus Dental, Culver City, CA) and take-home, dentist-monitored tray



Figure 1. Preoperative view of the patient's central incisors demonstrates presence of brown discolorations.



Figure 2. Preoperative shade comparisons were made using shade tabs (ie, A2).



Figure 3. Facial view following bleaching. Note that the previous brown stains turned to white spots and areas of hypocalcification.

bleaching. Then, if insufficient to achieve the patient's anticipated result, the next most conservative approach in the sequence protocol would be the placement of direct composite restoratives (eg, Gradia Direct, GC America, Alsip, IL; Tetric EvoCeram, Ivoclar Vivadent, Amherst, NY), including recently introduced flowable varieties (eg, Gradia Direct LoFlo, GC America, Alsip, IL; Tetric Flow, Ivoclar Vivadent, Amherst, NY). These flowable composite materials—with improved physical properties, handling characteristics, and aesthetics—can contribute to a clinician's ability to more precisely and predictably place them in order to reproduce the optical properties of the natural tooth structure.¹⁰

The following case demonstrates a conservative treatment sequence for the aesthetic correction of discolored anterior maxillary dentition. In-office whitening was first performed, followed by an at-home whitening regimen and a subsequent direct resin buildup.



Figure 4. Composite shades were selected using a digital spectrophotometer (ie, EasyShade, Vident, Brea, CA).



Figure 5. Conservative beveled preparation was used to remove the white spots and areas of hypocalcification.

Case Presentation

A 27-year-old female presented with a chief complaint that teeth #8(11) and #9(21) exhibited brown stains on the facial aspects (Figure 1). She preferred conservative treatment and was not interested in indirect veneers. Following a thorough examination that included digital photographs and radiographs, a conservative aesthetic treatment plan was developed that would proceed from the least-invasive treatment option (ie, in-office and take-home, tray-based bleaching) to the next (ie, placement of direct composite) in order to ensure that the patient's aesthetic objectives were achieved.

Phase 1: Tooth-Whitening Procedures

An in-office, light-activated, tooth-whitening system (ie, GC TiOn In-Office Tooth Whitening System, GC America, Alsip, IL) that contains a titanium photocatalyst was used to whiten the patient's teeth and remove the intrinsic

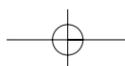
staining (Figure 2).¹¹ The photocatalyst enabled the use of a lower concentration (20%) of hydrogen peroxide—thereby promoting decreased patient sensitivity¹²—while still achieving the desired whitening effect. While professional tooth-whitening products rely on proven technologies to reduce intrinsic stain and change the inherent tooth color—such as varying concentrations of hydrogen peroxide for in-office power bleaching or 10% to 15% carbamide peroxide for at-home bleaching—it has been proposed that the use of activating agents could enhance the performance of hydrogen peroxide and natural enzymes in the whitening process.¹³

In this case, the photocatalyst maximized the whitening effect of the hydrogen peroxide. Additionally, the use of a pH-balanced whitening system reduced the likelihood of tooth demineralization, which further contributed to patient comfort. Significant color changes and whitening effects were noted as a result of the interaction between the bleach and light variables.¹⁴ It has been shown that the application of light significantly improves the whitening efficacy of some bleach materials.¹⁴

Additionally, the patient followed up with 5 days of an at-home tooth-whitening regimen (ie, GC TiOn Take Home, GC America, Alsip, IL) that contained a potassium nitrate desensitizer and sodium fluoride. While the bleaching treatment did significantly whiten the patient's dentition, areas of white spots and hypocalcification developed in the areas that were previously stained (Figure 3).



Figure 6. Beveled preparations were created using a diamond bur, leaving the sound tooth structure intact.



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Phase 2: Direct Composite Correction of Tooth Color

Based on the success of other clinicians in placing composite restorations to correct the appearance of such dentition,¹⁵ the decision was made to place a combination of direct restoratives (ie, Gradia Direct LoFlo and Gradia Direct, GC America, Alsip, IL). The flowable was used as a base due to its greater adaptability to the cavity walls; this made the subsequent application of a microhybrid composite necessary. Using shade tabs from the composite systems and a digital spectrophotometer, the appropriate composite shades for the dentin and enamel layers were determined (Figure 4).

Three weeks after bleaching, the white spots and hypocalcifications were removed via minimal beveled preparations (Figures 5 and 6), and the teeth were readied for the composite restorations. It has been shown that bonding composites to bleached dentition three weeks after whitening produces bond strengths similar to untreated teeth.¹⁶ The preparation design was very specific to the outline and demarcation of the hypocalcification and unaesthetic areas, with the preparations completed to the depth of the hypocalcification, into sound enamel and dentin.

The teeth were etched and adhesively conditioned using a single-component adhesive. The bonding system was brushed onto the preparations using a microbrush and allowed to sit for 10 seconds (Figure 7), after which it was thinned with high air pressure and then light cured for 10 seconds per tooth using an LED curing light (ie, G-Light, GC America, Alsip, IL).

Using a syringe, the A1-shaded flowable composite (ie, Gradia LoFlo, GC America, Alsip, IL) was carefully placed onto teeth #8 and #9 and into the micropreparations, ensuring that the material was applied uniformly across the prepared areas (Figure 8). The handling characteristics of this flowable composite—which also contained a radiopaque, prepolymerized filler—were such that it did not slump during placement, yet moved and adapted easily to the dentin walls of the preparation. It has been noted in the literature that the improved handling characteristics available from current flowable systems have expanded today's treatment



Figure 7. The preparations were etched and adhesively conditioned using a seventh-generation, one-component system.

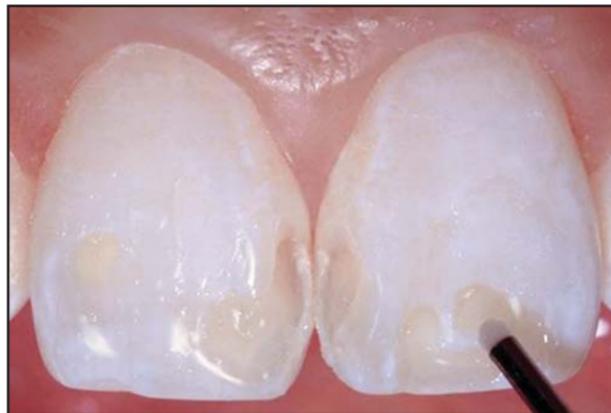


Figure 8. The flowable composite in dentin shade A1 was placed using a syringe.



Figure 9. A bleached (BW) shade of the flowable composite was placed using a syringe.

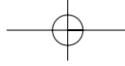


Figure 10. A microhybrid composite (ie, Gradia Direct, GC America, Alsip, IL) was placed as the final enamel layer in a bleached shade.



Figure 11. Ultrafine polishing discs were used to finish the restorations prior to surface texturing.



Figure 12. The surface texture was rendered through the utilization of a diamond bur.

options.¹⁰ This flowable layer was light cured for 20 seconds per tooth with an LED curing light.

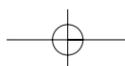
Similarly, a bleached (BW) shade of the flowable composite was applied using a syringe (Figure 9). This layer was contoured with a composite placement instrument and light cured for 20 seconds per tooth with an LED curing light.

To complete the restoration, a bleached enamel-shaded composite (ie, Gradia Direct, GC America, Alsip, IL) was placed over the dentin composite on both teeth #8 and #9 (Figure 10). The composite was carefully sculpted with instrumentation to facilitate finishing and polishing and, upon completion of placement, cured for 20 seconds per tooth.

To create surface texture and tertiary anatomy, ultrafine polishing discs (eg, Sof-Flex Extra Thin, 3M Espe, St. Paul, MN; FlexiDisc, Cosmedent, Chicago, IL) and diamond burs were used (Figures 11 and 12). To impart additional micromorphological characterizations on the facial surfaces, a 30-fluted carbide bur (ie, ET-9 UF, Brasseler USA, Savannah, GA) was also utilized (Figure 13). A total depth of cure was achieved by light curing the restorations from multiple aspects for a total of 40 seconds per tooth. Cups, points, and diamond polishing paste (eg, Jiffy, Ultradent Products, South Jordan, UT; Enamelize, Cosmedent, Chicago, IL) were used to polish the restorations and create a natural, harmonious aesthetic appearance (Figures 14 and 15).

Conclusion

Principles of minimal intervention are increasingly dictating the manner in which restorative procedures are scheduled and their related materials placed as part of an elective aesthetic protocol. In this case presentation, the patient's aesthetic expectations were achieved through a planned sequence of conservative approaches to address the discoloration of her anterior maxillary dentition. The combined use of in-office and take-home bleaching systems designed to enhance whitening efficiency and patient comfort was implemented initially to produce the desired effects. Had the bleaching process not uncovered the underlying hypocalcifications, no further restorative treatment would have been undertaken.



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Figure 13. Final surface refinement with 30-fluted carbide bur.



Figure 14. Postoperative facial view of the completed restorations in a natural smile.



Figure 15. Postoperative view of the aesthetic enhancement achieved on teeth #8 and #9 using a minimally invasive approach.

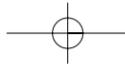
Since unforeseen hypocalcifications were present, however, it was necessary to proceed with the placement of a flowable composite and a microhybrid composite resin in a minimally invasive manner using micropreparations in order to achieve the patient's aesthetic goals. When conservative preparation designs are used, it behooves clinicians to consider the incorporation of flowable composites into the restorative protocol that are well suited to such indications.^{17,18}

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CONTINUING EDUCATION (CE) EXERCISE No. X



To submit your CE Exercise answers, please use the answer sheet found within the CE Editorial Section of this issue and complete as follows: 1) Identify the article; 2) Place an X in the appropriate box for each question of each exercise; 3) Clip answer sheet from the page and mail it to the CE Department at Montage Media Corporation. For further instructions, please refer to the CE Editorial Section.

The 10 multiple-choice questions for this Continuing Education (CE) exercise are based on the article "Incorporating flowable composites into the minimally invasive treatment sequence for aesthetic enhancement," by Frank J. Milnar, DDS. This article is on Pages 000-000.

1. Which of the following is NOT considered a minimally invasive technique for whitening stained teeth?
 - a. Veneers.
 - b. Bleaching.
 - c. Direct composite restorations.
 - d. None of the above.
2. Light-activating agents may enhance the performance of hydrogen peroxide in the whitening process. They may also enhance the performance of natural enzymes.
 - a. Only the first statement is true.
 - b. Only the second statement is true.
 - c. Both statements are true.
 - d. Neither statement is true.
3. Which of the following are listed as causes of staining?
 - a. Aging.
 - b. Injury.
 - c. Disease.
 - d. All of the above.
4. What concentration of hydrogen peroxide was used in the case described in the article?
 - a. 10%.
 - b. 15%.
 - c. 20%.
 - d. 25%.
5. In the case presented in this article, which of the following was used for take-home tray bleaching?
 - a. Hydrogen peroxide.
 - b. Carbamide peroxide.
 - c. Both a and b.
 - d. Neither a nor b.
6. Although minimally invasive, anesthesia was used to desensitize prior to bleaching. Painless bleaching can be performed without the use of anesthesia.
 - a. Only the first statement is true.
 - b. Only the second statement is true.
 - c. Both statements are true.
 - d. Neither statement is true.
7. Which of the following is out of order in the sequence protocol followed in this case?
 - a. In-office bleaching.
 - b. Take-home bleaching.
 - c. Placement of direct composite restoratives.
 - d. None of the above.
8. What is the likelihood that demineralization will take place by using a pH-balanced whitening system?
 - a. Not at all likely.
 - b. Less likely.
 - c. More likely.
 - d. It has no effect.
9. Which of the following is NOT an enhancement contribution of flowable composite materials?
 - a. Function.
 - b. Aesthetics.
 - c. Physical properties.
 - d. Handling characteristics
10. Which of the following constituted the final step of the restorative procedure?
 - a. Polishing of composite resin.
 - b. At-home tooth whitening.
 - c. In-office tooth whitening.
 - d. None of the above.

