Minimally Invasive “Cure” for Life-Long Discoloration

Authored by Frank J. Milnar, DDS

Upon successful completion of this CE activity 2 CE credit hours will be awarded
Minimally Invasive “Cure” for Life-Long Discoloration

Effective Date: 10/1/2013    Expiration Date: 10/1/2016

ABOUT THE AUTHOR

Dr. Milnar is a graduate from the University of Minnesota, School of Dentistry. He is an accredited member of the American Academy of Cosmetic Dentistry and a board examiner for Accreditation. Dr. Milnar maintains a full-time practice in St. Paul, Minn, emphasizing appearance related dentistry. He has published numerous articles about the direct placement of composites, shade selection, and porcelain materials and is on editorial review boards for dental journals. Dr. Milnar is cofounder of the Minnesota Academy of Cosmetic Dentistry and has lectured extensively within the US Armed Forces as well as internationally on the subject of direct composite restorations, shade selection and porcelain materials. He has been voted “Top Dentist” for the last several years in the Minneapolis/St. Paul Magazine. He has been named a Leader in Continuing Education by Dentistry Today. He can be reached at the Web site stpaulsmiles.com.

Disclosure: Dr. Milnar discloses that he received financial support from Tokuyama Dental America.

INTRODUCTION

Often the first noticeable difference in varying dentition between individuals is tooth color. Tooth discoloration is caused in one of 2 ways. These causes can be extrinsic when dietary colorants or other deposits attach to the tooth surface or pellicle layer through tobacco use, coffee or tea ingestion, poor oral hygiene, and use of chemical plaque preventative agents.

The causes can also be intrinsic. The formation of intrinsic discoloration occurs during tooth development (or as a result of trauma) and produces altered light transmission properties of the tooth structure due to pulp necrosis or variations in the dentin. As a result, the permanent dentition is affected by turning a brown hue. Unfortunately, many more conditions that can create permanent discoloration include dental fluorosis, plaque calcifications, and the prenatal use of tetracycline.

Tooth discoloration can have psychological effects on individuals. A study conducted by the US Air Force Dental Corps identified what people thought characterized an attractive smile. A total of 297 subjects viewed 8 photographs of female smiles, 8 photographs of male smiles, and completed a questionnaire to rate the attractiveness of each photograph. The study concluded that in all cases, tooth shade was the most important factor in determining an attractive smile. This is relevant because science has already established that dentofacial attractiveness greatly affects the psychosocial well-being of an individual.

Unfortunately, managing discolored teeth can be a complex problem, and treatment usually requires a combination of modalities for predictability. For cases in which the discoloration is not extreme, dentist dispensed or supervised at-home or in-office bleaching procedures may be adequate to enhance tooth shade. Bleaching procedures using hydrogen peroxide or carbamide peroxide have been proven effective and safe, but there are reports of adverse reactions such as cervical root resorption and post-treatment sensitivity that can last from a few hours up to several days. However, with brown intrinsic staining, the discoloration is often more difficult to address, and bleaching procedures alone will likely not be sufficient to achieve the desired result.

Porcelain veneers have been a preferred and effective option for many patients to treat discolored teeth. The reasons for this include the material's high strength, high aesthetics, biocompatibility, and clinical longevity when proper adhesive bonding protocol is followed. Some disadvantages of indirect veneers are aggressive tooth preparation requirements and technique-sensitive adhesive procedures that, if not performed precisely, result in debonding or marginal leakage.

All-ceramic crowns are another treatment option for masking discolored teeth. These materials, such as lithium
disilicate and leucite-reinforced porcelains, exhibit increased durability and aesthetics due to natural/high translucency. This makes them an excellent option for treating discoloration in the posterior region where high strength is necessary and aesthetics are still a concern. This treatment option should only be considered for teeth with significant loss of anatomy or severe discoloration, as all-ceramic crowns generally require more tooth preparation as compared to other full-coverage options.  

Despite the multitude of options available, there are several reasons why patients may decline these recommended aesthetic dental treatments for correcting tooth discoloration. These may include time constraints or financial considerations that restrict the methods or materials chosen by the dentist. A patient's fear/anxiety level pertaining to certain procedures like aggressive tooth preparation must also be considered as a possible reason for refusing treatment.

**Considering Minimally Invasive Options**

When minimally invasive preparation is ideal, dentist-monitored in-office and at-home bleaching procedures, followed by carefully planned and placed direct composite restorations, are an option that yields favorable results to satisfy both patient and dentist aesthetic goals. Direct composite is considered among clinicians to be the least invasive and most conservative method to restore aesthetically displeasing or diseased teeth to stable color, form, and function. When paired with bleaching, this combination of procedures achieves the desired appearance with minimal discomfort, low cost, predictability, and excellent success rates. There is also a very high rate of patient satisfaction associated with these treatment methods.

The first generation of dental composites was chemically polymerized, very brittle, and only suitable for restoring anterior teeth. These composites were usually quartz-filled, required hand mixing of self-curing pastes that only came in 4 shades, and were difficult to work with. Wear and fracture resistance were low, the materials did not meet compressive and tensile force requirements, were difficult to polish, and exhibited high surface roughness.

Even as they evolved, direct composites were, at first, reserved only for the most skillful clinicians, because the careful layering technique, sculpting, and artistic coloration were best performed by dentists who had mastered the material. The 1970s brought about light-cured composites with smaller filler particles that were more color stable than their predecessors and demonstrated enhanced wear characteristics. A few years later, filler particle size decreased, load increased, and subsequently the material strengths became significantly higher, allowing for clinical longevity in the posterior region. The next material advancement was in using nanoparticles. These particles are very small, ranging in size from one nm to 100 nm, increasing filler loading and thusly enhancing the physical and mechanical properties of the material.

Today's composites are available as microfilled, microhybrid, nanohybrid, and most recently suprananohybrid materials. These composites range in viscosity from packables that have handling characteristics similar to amalgam, to flowables that can be syringed directly into preparations. These advanced materials are important to clinicians because they provide the ability to deliver restorations that are aesthetic due to their light reflecting/refracting properties, bond well to dentin and enamel, and they attain and maintain a good polish and gloss. Among the composites to date that have addressed these requisites are Estelite Sigma Quick (Tokuyama Dental America), Filtek Supreme Ultra (3M ESPE), Tetric EvoCeram and IPS Empress Direct (Ivoclar Vivadent), Venus Diamond and Venus Pearl (Heraeus Kulzer), and Renamel Microfill (Cosmedent), to name just a few.

The newest version of direct composite, suprananohybrids (Estelite Sigma Quick), demonstrates the combination of characteristics that dentists have desired from composites for 30 years. Suprananohybrid composite features exceptional strength while also displaying enhanced optical properties. Suprananohybrids also demonstrate chameleon shades that allow for easy matching to natural tooth structure. This enables dentists to reduce overhead and inventory while still maintaining their ability to create highly aesthetic restorations in all regions of the mouth. Additionally, there is almost no variation in color or volume before and after light-curing, so there is greater predictability when placing restorations.
In fact, several studies were conducted to identify the amount of volumetric shrinkage suprananohybrid composites undergo due to polymerization, and the results illustrate that the rate of volumetric shrinkage is statistically low (ie, about 1.3% to 2%).23,24 These composites also bond well to all tooth surfaces. In a study testing microtensile bond strength of an experimental adhesive between dentin and different restorative materials, the suprananohybrid performed well, demonstrating a good microtensile bond to dentin with strength of 51.0 MPa.25

Aesthetically, due to the submicron particle size of the filler, these composites can be polished very quickly to a high gloss that is maintained for years and enhanced using a systematic finishing and polishing kit (eg, Shofu Dental).

CASE REPORT
A female patient in her 40s presented for a consultation to discuss treatment options for correcting the appearance of her severely discolored teeth (Figure 1). A comprehensive examination was performed that included an aesthetic evaluation.

She had been “afflicted” with such discoloration and aesthetic dilemma since age 13 years that affected her psychologically. However, despite the social stigma she endured due to the tooth discoloration, she was reluctant to undergo the more aggressive treatments (eg, all-ceramic crowns, veneers) that previous dentists had recommended.

As she described the prosthodontic solutions that had been suggested to her, it was clear that her previous consultations did not include discussion about tooth structure removal or tooth shade. Additionally, it was apparent that there was a lack of clarity within the profession regarding minimally invasive alternatives for enhancing her smile at this time that would have allowed for the subsequent opportunity to consider prosthodontic treatments in the future. The patient indicated that she wanted to pursue a minimally invasive option and wanted to understand what could be possible.

During the aesthetic evaluation, it was noted that the patient displayed a full smile. However, it was determined that her aesthetic concerns could be addressed with a combination of in-office whitening (eg, BriteSmile) and direct composite restorations (Estelite Sigma Quick) in a minimally invasive, reversible, and repairable way. Her dental condition was good, so she was scheduled for a hygiene appointment and for tooth whitening.

Clinical Treatment
Fourteen days after completing the tooth whitening procedure (Figure 2), the patient’s tooth color could be managed in the labial enamel, with minimal tooth preparation required. The composite selected for the case was a suprananohybrid (Estelite Sigma Quick), since this material would provide the simplified shade selection necessary to cover the tooth space using one or 2 shades, making it ideal for this type of everyday dentistry.22 Yet, it would enable...
effective shade matching with the adjacent natural dentition, maximization of the selected shades for recreating the tooth's inherent hue, chroma and value, and therefore realization of aesthetic principles.

During the restorative appointment, the proposed dentin composite shades (eg, B1 on the left, A1 on the right) were previewed on the unprepared teeth (Figure 3). Shade A1 was selected. Then proposed enamel composite shades (eg, WE on the left, CE on right) were previewed (Figure 4), and shade CE was selected.

Teeth Nos. 8 and 9 were evaluated to outline areas of concern regarding color and zones of high chroma areas (Figure 5), after which a minimally invasive preparation was begun using a No. 331-0913 diamond (Shofu Dental) (Figure 6). Initially, the preparation demonstrated areas of high chroma. Bevels were placed using a No. 7903-0939 diamond (Shofu Dental) to complete the preparation (Figure 7).

Because a small area of the preparation extended into dentin, a selective-etch technique was used (Figure 8). The etchant was then rinsed thoroughly, and the teeth were dried. Next, a dentin bonding agent (Bond Force [Tokuyama Dental America]) was placed according to the manufacturer’s instructions (Figure 9) and light-cured.

Using freehand direct composite artistry, the initial dentin composite layer (Estelite Sigma Quick) in shade A1
was applied and sculpted onto tooth No. 8, then light-cured (Figure 10). The A1 dentin composite was then placed on tooth No. 9 (Figure 11) in a similar manner and light-cured. A matrix (Omni Band [Ultradent Products]) was placed, after which the final CE shade composite enamel layer was placed on tooth No. 8 and light-cured (Figure 12). The CE composite enamel layer was then applied to tooth No. 9 and light-cured.

Pencil lines were drawn to identify necessary line angles and facilitate construction of primary anatomy (Figure 13). These line angles were then modified in the restorations using a disc (Super Snap [Shofu Dental]) (Figure 14). Next, a CTF yellow Robot carbide finisher (Shofu Dental) was used to create the secondary anatomy (Figure 15). Subsequently, a Dura-Green Stone No. 1211252 (Shofu Dental) was used to create the tertiary anatomy (Figure 16).

The restorations were initially polished using One Gloss (Shofu Dental) (Figure 17). A buffing disc (Super Snap Buff Disc [Shofu Dental]) moistened with water continued the polishing sequence to create a preclustered surface (Figure 18). The restorations achieved their final luster through the use of a buffing disc (Super Snap Buff Disc) and polishing paste (Direct Dia [Shofu Dental]) (Figure 19).

The handling, physical, and visual properties demonstrated in the selected composite (Estelite Sigma Quick) represent the evolution of direct composites to their currently advanced state, which enabled the use of only 2 ideal dentin and enamel shades for creating the chameleon effect necessary for the restorations to appear naturally aesthetic (Figure 20).

IN SUMMARY
The in-office whitening and suprananohybrid composite, combined with the dentist’s full understanding of the transformational possibilities of responsible aesthetics, essentially “cured” this patient’s discolored smile, with which she had been afflicted all her life.
REFERENCES

POST EXAMINATION INFORMATION

To receive continuing education credit for participation in this educational activity you must complete the program post examination and answer 6 out of 8 questions correctly.

Traditional Completion Option:
You may fax or mail your answers with payment to Dentistry Today (see Traditional Completion Information on following page). All information requested must be provided in order to process the program for credit. Be sure to complete your “Payment,” “Personal Certification Information,” “Answers,” and “Evaluation” forms. Your exam will be graded within 72 hours of receipt. Upon successful completion of the post-exam (answer 6 out of 8 questions correctly), a letter of completion will be mailed to the address provided.

Online Completion Option:
Use this page to review the questions and mark your answers. Return to dentalcetoday.com and sign in. If you have not previously purchased the program, select it from the “Online Courses” listing and complete the online purchase process. Once purchased the program will be added to your User History page where a Take Exam link will be provided directly across from the program title. Select the Take Exam link, complete all the program questions and Submit your answers. An immediate grade report will be provided. Upon receiving a passing grade, complete the online evaluation form. Upon submitting the form, your Letter Of Completion will be provided immediately for printing.

General Program Information:
Online users may log in to dentalcetoday.com any time in the future to access previously purchased programs and view or print letters of completion and results.

This CE activity was not developed in accordance with AGD PACE or ADA CERP Standards. CEUs for this activity will not be accepted by the AGD for MAGD/FAGD credit.

POST EXAMINATION QUESTIONS

1. Conditions that can often cause permanent discoloration include dental fluorosis, plaque calcifications, and the prenatal use of tetracycline.
   a. True   b. False

2. Science has already established that dentofacial attractiveness rarely affects the psychosocial well being of an individual.
   a. True   b. False

3. Bleaching procedures using hydrogen peroxide or carbamide peroxide have been proven effective and safe, but there are reports of adverse reactions such as cervical root resorption and post-treatment sensitivity that can last from a few hours up to several days.
   a. True   b. False

4. Porcelain veneers have been a preferred and effective option for many patients to treat discolored teeth.
   a. True   b. False

5. All-ceramic crowns are another treatment option for masking discolored teeth.
   a. True   b. False

6. A patient’s fear/anxiety level pertaining to certain procedures like aggressive tooth preparation should not be considered as a reason for refusing treatment.
   a. True   b. False

7. Direct composite is considered among clinicians to be the least invasive and most conservative method to restore aesthetically displeasing or diseased teeth to stable color, form, and function.
   a. True   b. False

8. The newest version of direct composite, suprananohybrids demonstrate the combination of characteristics that dentists have desired from composites for 30 years.
   a. True   b. False
PROGRAM COMPLETION INFORMATION

If you wish to purchase and complete this activity traditionally (mail or fax) rather than online, you must provide the information requested below. Please be sure to select your answers carefully and complete the evaluation information. To receive credit you must answer 6 of the 8 questions correctly.

Complete online at: dentaledge.com

TRADITIONAL COMPLETION INFORMATION:
Mail or fax this completed form with payment to:

Dentistry Today
Department of Continuing Education
100 Passaic Avenue
Fairfield, NJ 07004
Fax: 973-882-3622

PAYMENT & CREDIT INFORMATION:

Examination Fee: $40.00  Credit Hours: 2

Note: There is a $10 surcharge to process a check drawn on any bank other than a US bank. Should you have additional questions, please contact us at (973) 882-4700.

☐ I have enclosed a check or money order.
☐ I am using a credit card.

My Credit Card information is provided below.

☐ American Express  ☐ Visa  ☐ MC  ☐ Discover

Please provide the following (please print clearly):

Exact Name on Credit Card

/  
Credit Card #  Expiration Date

Signature

PERSONAL CERTIFICATION INFORMATION:

Last Name  (PLEASE PRINT CLEARLY OR TYPE)
First Name
Profession / Credentials  License Number
Street Address
Suite or Apartment Number
City  State  Zip Code
Daytime Telephone Number With Area Code
Fax Number With Area Code
E-mail Address

ANSWER FORM: VOLUME 32 NO. 10 PAGE 100
Please check the correct box for each question below.

1.  ☐ a. True  ☐ b. False
2.  ☐ a. True  ☐ b. False
3.  ☐ a. True  ☐ b. False
4.  ☐ a. True  ☐ b. False
5.  ☐ a. True  ☐ b. False
6.  ☐ a. True  ☐ b. False
7.  ☐ a. True  ☐ b. False
8.  ☐ a. True  ☐ b. False

PROGRAM EVALUATION FORM
Please complete the following activity evaluation questions.

Rating Scale: Excellent = 5 and Poor = 0

Course objectives were achieved.  
Content was useful and benefited your clinical practice.  
Review questions were clear and relevant to the editorial.  
Illustrations and photographs were clear and relevant.  
Written presentation was informative and concise.  
How much time did you spend reading the activity and completing the test?  
What aspect of this course was most helpful and why?  

What topics interest you for future Dentistry Today CE courses?

This CE activity was not developed in accordance with AGD PACE or ADA CERP Standards.  
CEUs for this activity will not be accepted by the AGD for MAGD/FAGD credit.