Injection Overmolding for Aesthetics and Strength, Part 2

Treating Black Triangles in Post-Ortho Cases

David Clark, DDS

This is part 2 of a 2-part article series. Part one of Dr. Clark's article was published in the August 2014 issue of Dentistry Today *and can be found in our archived articles at the Web site dentistrytoday.com.*

INTRODUCTION

Treatment of black triangles, which was rarely discussed 5 years ago, has exploded since then. Seven years ago, I invented and patented special diastema closure matrices, along with patenting the process of restoratively driven papilla regeneration (US Patent No. 8,393,897). I did a Google search at the time, and there were only a handful of results when I typed in the phrase *dental black triangles*. Since the release of Bioclear, I have lectured and published extensively about the Bioclear method for treating this difficult problem. The public has definitely begun to catch on, as witnessed by my office having been bombarded with patient requests to fly in for treatment or be referred to someone in their area that has received training (Figure 1). It's incredible, really. Why the big fuss? Today, that same Google search yields a staggering 348,000 sites mentioning this problem/treatment.

This article will explain why the explosion in interest is beginning, and will present an ethical modality for treatment, along with a case presentation.

Treating Black Triangles: The New Wave?

Many doctors who have taken courses at the Bioclear learning center, at dental meetings, or who have simply purchased the Bioclear Matrix System and watched the instructional videos report that they are suddenly doing a very large number of cases. They share truly inspirational stories of happy patients who look in the mirror immediately after treatment, then cry with joy and hug the doctor and team. Periodontists, orthodontists, and the public are referring patients to these offices. Hundreds of dental offices are suddenly featuring "black triangle elimination" as a prominent menu item on their home page of their Web sites, right next to "implants" or

Figure 1. Mural of black triangle smile photos. When patients contact my office after reading an article or seeing a video on YouTube, we ask them to take and send pictures of their teeth with their phone. From these images we begin to assess them as potential candidates for treatment. (Note: The author has treated more than 700 black triangles in just the last 7 years.)

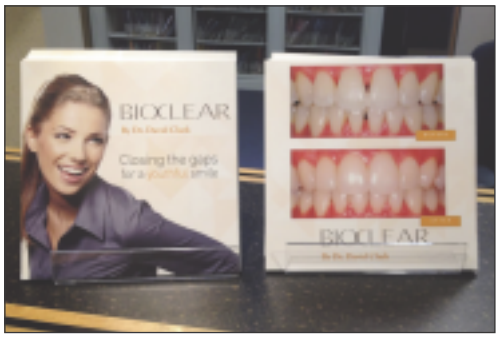

Figure 2. Prominently displayed brochures that talk about black triangles and information on how to successfully treat them are helpful informational tools.

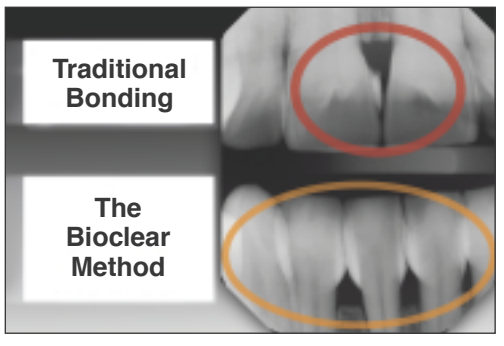

Figure 3. The top radiograph (traditional bonding) shows a typical iatrogenic black triangle treatment done by a clinician who, despite good intentions, was not using the most up-to-date techniques and materials to successfully accomplish this procedure. The lower radiograph (the Bioclear method) is a typical post-op radiograph of one of our black triangle patients after injection overmolding of 7 teeth with 5 black triangles using the technique described in this article.

"veneers," etc. Many offices now prominently display black triangle brochures (Figure 2) instead of bleaching brochures. A recent study showed that patients dislike black triangles more intensely than either dark teeth or crowded teeth. When you look at the history of bleaching, starting about 25 years ago, no one asked for whitening procedures because there was no safe, straightforward procedure and, therefore, no promotion, no public buzz. Consequently, many people

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were walking around with yellow teeth. One third of all adults have black triangles, with most adult ortho treatment ending up with black triangles. Reflecting what happened with tooth whitening, will black triangles be the next wave? Don't bet against it.

Increasing Professional Awareness and Treatment Options

I would encourage you (especially GPs and orthodontists) to go online (Google the phrase "black triangles teeth") and read about how upset so many patients are about post-orthodontic black triangles. Many would have preferred their crowded teeth rather than ending up with black triangles. Here is a small sample of what patients have told me:

- "My dentist did not listen to me or understand how much this [black triangle] really bothers me."
- "I have been going to dentists for years asking for help. They all say my triangle gaps are not bad enough and that they cannot help me."
- "I was told, due to my grafting issues, I would not be able to do anything else to close the gaps. I had composites placed, and that didn't work."
- "I feel worse about my teeth since my orthodontic treatment was done. My dentist and orthodontist said my results were because of the shape of my teeth, and that was my only option. I never would have gone through ortho had I known about the black triangles."
- "My dentist and orthodontist told me there was nothing I could do with my big gaps. I refused to be okay with that and researched for myself and found an option to help me."
- "I do not like the idea of shaving my teeth down to place veneers to hide my black triangles."

Orthodontist Dr. Chad Smart Shares His Comments on the Topic of Black Triangles

The practice of orthodontics has changed significantly during the past decade. During that time, there has been a significant increase in the number of adults seeking treatment. Currently that number is close to 40% of all the new patients who come into my office. Many of these adult patients will have significant black triangles after the alignment of their dentitions that are too large to adequately address with interproximal reduction alone. In these cases, I often consulted with the patient's general dentist to seek a restorative solution for the problem, only to have been told that there was no restorative solution. This left me, and my patients, very frustrated, since many patients would prefer crooked teeth to black triangles. The problem was significant enough that I would dissuade adult patients from doing orthodontic treatment if I thought that black triangles were likely. My introduction to the Bioclear Matrix system changed all that completely. Dr. Clark's matrix system gives me a reliable, aesthetic, and long-term solution for these challenging cases. I no longer have the frustration of completing a well-treated orthodontic case only to find that the patient is dissatisfied with the outcome due to black triangles. I can now treat adult cases with confidence knowing that the black triangles can be predictably eliminated.

Figure 4. Pre-op smile of a young health professional who *absolutely hated* her post-ortho black triangles.

Figure 5. Photo of the patient's lips in repose. Our eyes are immediately drawn to the obvious, a black triangle.

Figure 6. Immediate post-op photo.

Figure 7. A rubber dam was placed prior to beginning treatment. This heavy latex dam (Hygienic) serves a compressive purpose during the technique. The papilla between teeth Nos. 7 and 8 was nicely compressed (typically 2.0 mm of horizontal compression); however, where the dam was torn, the papilla between teeth Nos. 8 and 9 presented as a problem.

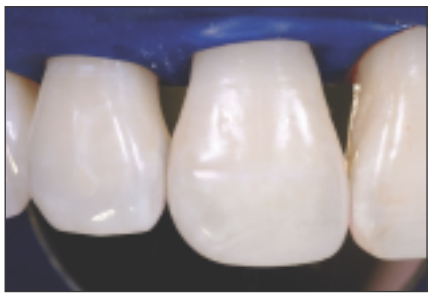


Figure 8. This image shows a new rubber dam in place. These images are shown to demonstrate how important the proper placement of a heavy rubber dam can be to manage the soft tissue. (Currently, the author's chairside assistant *gently sands* each contact *before* the rubber dam is placed to avoid tearing the material.)

Figure 9. The Bioclear DC-201 matrix (front and side views), designed for the mesial of central incisors, is shown in straight and lateral views. (Note the significant change in emergence profile between the root apron and the cemento-enamel junction bulge.)

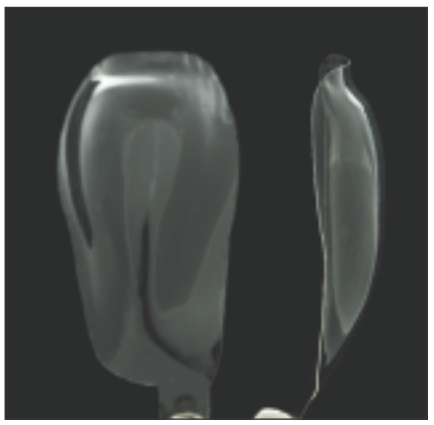
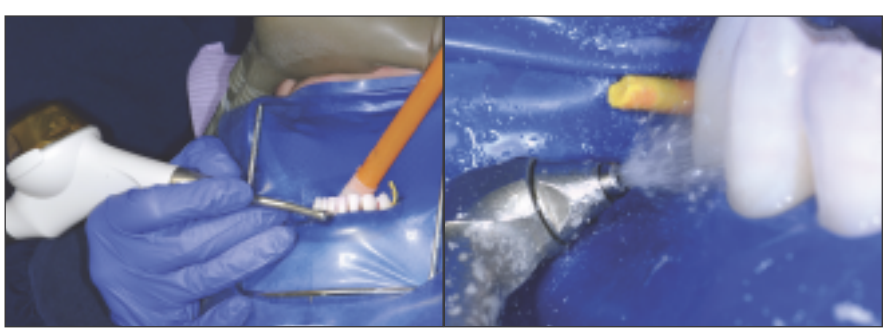


Figure 10. The slightly smaller DC-202 matrix (front and side views); the gingival curvature is similar to the DC-201. (Note the significant incisal curvature, designed specifically for the distal of an incisor.)

Figure 11. Biofilm was stained *after* cleaning the teeth carefully with a scaler and coarse pumice in a prophy cup. (Currently, the author skips this step, going straight to blasting.)



Figures 12 and 13. Photos demonstrating the use of the Bioclear Blaster to remove biofilm, 360° around the tooth. It provides peace of mind that the composite margins absolutely will *not* stain. The water slurry makes it less messy than using dry air abrasion units.

Black Triangles: Prevalence and Patient Attitudes

One third of adults suffer from black triangles, which can also be referred to as *open gingival embrasures*.[1] Besides being unsightly and also prematurely aging the smile, black triangles are prone to accumulate food debris and excessive plaque.[2] A recent study of patient attitudes found dissatisfaction with black triangles to rank high among aesthetic defects. Black triangles ranked third on the list, following carious lesions and dark crown margins, but above dark teeth and crowded teeth.[3] In the author's opinion, this aesthetic dilemma should command more attention within our profession. Of course, until recently, there has been no predictable and minimally invasive way to treat patients with black triangles. Instead of simply accepting the usual struggling and improvising that had become the norm in an attempt to treat this difficult clinical/aesthetic challenge, I developed a specific predictable protocol along with a matrix system specifically designed to treat this widespread problem.

So, why is "bonding" such a dirty word when discussing black triangles?

Many patients say that their dentists were very uncomfortable with the use of direct composite. This is due to all the problems and challenges that we have seen historically when attempting to successfully/aesthetically close a black triangle (Figure 3). In the past, traditional restorative closure of the black triangle consisted of a 2-dimensional approach, "patty caking" a wing of paste composite from the facial aspect to essentially block the light. This technique decreased the amount of blackness in the interdental area; however, this led to multiple new problems including staining, de-bonding, periodontal inflammation, food impaction, and so on.

CASE REPORT
Treating the Post-Ortho Black Triangle: 3-D Treatment of a 3-D Problem

Our patient, a young health professional, *absolutely hated* her black triangles that had formed during orthodontics. She decided to fly across the country right after reading about the treatment protocol offered in our office (Figures 4 to 6). She wanted her unaesthetic situation corrected with a minimally invasive, healthy, and long-term solution.

Part one of this article series (in the August 2014 issue of *Dentistry Today*) was focused on the composite resin selection and on avoiding translucency. (Visit dentistrytoday.com to review those concepts in Part one of this article series.) In Part 2, we are focusing on 3 other important aspects: (1) using a dedicated diastema closure matrix that retracts the tissue and also changes the emergence profile subgingivally, (2) heating the composite for injection overmolding; and, and (3) the complete removal of biofilm for stain-free margins.

The Change in Emergence Profile Must Occur Subgingivally

Most dentists are still using the flat piece of Mylar that has been used for decades during the placement of anterior composites. It is virtually impossible to do this technique in a predictable and

healthy way, especially with large gaps, without a dedicated diastema closure matrix (Figures 7 to 10). The use of an ideally punched and clampless rubber dam, which can easily be placed without anesthesia, enhances the performance of the matrix. The 2.0 mm of compression in the soft tissue allows an ideal predictor of the static tension required of the composite shape to regenerate a papilla. When the matrix and dam are removed, the papilla immediately fills the space, and the patient leaves the office with complete and instant removal of the black triangle.

Blasting to Remove Biofilm

Two factors demand absolute compliance with the complete removal of biofilm using the aluminum trihydroxide air-water slurry in Figures 11 to 13. First, the tooth is not drilled down and, second, the interproximal area is typically a biofilm haven, which is virtually impossible to completely clean with scalers and prophy cups. If staining and de-bonds do not bother you, don't worry about biofilm. And, be aware that phosphoric acid used to etch the enamel removes very little biofilm, so do not assume that acid etch will clean the tooth.

Heating the Composite

There are no official statements from the manufacturers regarding the heating of composite resins, but multiple studies[4,5] have shown that heating composite to a temperature of 155°F improves flow, reduces microleakage, and assists in polymerization. Heating does not degrade the color stability or longevity of the restoration, and it is not harmful to the pulp. (For more information on heating composite resins, visit bioclearmatrix.com.) However, mainstream dentistry has not been compelled to move to heated composite. Most clinicians have not adapted heating of composites because they have not seen enough benefit. Today, however, we are learning that to integrate injection molding for procedures like the black triangle, heating the composite has many benefits.

Once a doctor has injected a balanced mix of heated flowable and regular paste composite into an anatomic matrix, that individual rarely goes back to cold (stiff) composites (Figures 14 and 15). It is, for a lack of a better description, a no-brainer. Heating paste composite creates more microscopic vibration or movement of the molecules, allowing for much-improved flow characteristics. This temporary liquefaction of paste composite is a welcome advancement in the placement of resin restorations (Figures 16 to 18). Clinicians are moving away from layering, packing, and stacking to the injection of a single load of composite. (Note: In this case, Filtek Supreme Ultra Plus [3M ESPE] in B-1 body shade was used in both the flowable and regular paste composite [dual viscosity] injection molding technique.)

The pre-op and immediate post-op photos (Figures 19 and 20) show instant remodeling of the gingiva. The 6-month post-op photo shows the final tissue contour, color, and texture (Figure 21). If the tissue is pink and the surface is stippled, the tissue is healthy.

CLOSING COMMENTS

The clinical technique, as described herein, can be classified as *additive dentistry*. It features injection overmolding, representing a revolutionary change in the way that we *think* about and use composite resin. There are times in clinical practice when we are presented with difficult challenges, for which no clear and predictable technique has been developed. Clinicians can muddle along, or instead be creative. It is from these struggles we often learn more about dental materials, and even a little bit more about ourselves as clinicians.

Figures 14 and 15. The heart of the process is the shape and smoothness of the matrix, coupled with the injectability of a balance of heated flowable and regular paste composites. The matrix is partially teased open with the tips of the syringes of both flowable and paste composites, and then the matrix springs closed upon removal of the composite syringes. (View the complete technique video at dentistrytoday.com.)

Figure 16. The case, at about midpoint in treatment, shown when the rubber dam was removed for the patient to take a break. (Note the startling contrast between treated and untreated areas.)

Figure 17. Another key to success in the restorative option of treating black triangles is the diversity of shapes and sizes of the Bioclear Matrix. Lower incisor teeth are small. The miniscule lower incisor matrices (DC-203) are crucial when treating the lower arch.

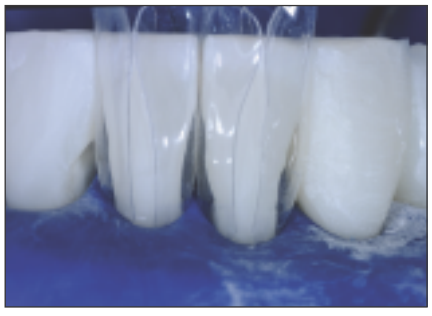


Figure 18. Because lower teeth are fairly mobile and the Bioclear matrix is only 50 µm thick, the author recommends treating 2 teeth at a time on the lower arch. On the upper arch, the author recommends using just 2 matrices (one tooth or one embrasure) at a time.

Figures 19 and 20. Immediate and 6-month post-op photos show that it was virtually impossible to tell where the composite started and ended. Note, in the photo, that there is no visible delineation between the paste and flowable composites. The excellent polish of the composite material and curvature of the Bioclear matrices resulted in an ideal tissue response; this was evidenced by the pink tissue and stippling of the gingiva to the tip of the papilla.

Figure 21. The 6-month post-op photo demonstrates the final tissue contour.

The post-op comments shared by my patient, who was featured in the clinical case report herein, sum up the importance of learning how to successfully treat unaesthetic black triangles for *your* patients: "I feel like I'm a new person! My confidence is higher and my self-esteem is improved. [This treatment] has made a huge impact on my life!"✦

Acknowledgement

The author would like to thank contributing orthodontist Dr. Chad Smart, who can be reached via e-mail at cwsmartdds@gmail.com.

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Dr. Clark, a 1986 graduate of the University of Washington School of Dentistry, founded the Academy of Microscope Enhanced Dentistry, an international association formed to advance the science and practice of microendodontics, microperiodontics, microprosthodontics, and microdentistry. He is a course director at the Newport Coast Oral Facial Institute in Newport Beach, Calif. He is co-director of Precision Aesthetics Northwest in Tacoma, Wash, and an associate member of the American Association of Endodontists. He lectures and gives hands-on seminars internationally on a variety of topics related to microscope-enhanced dentistry. He has developed numerous innovations in the fields of microdental instrumentation, imaging, and dental operatory design. He is proud to join with Clinical Research Associates in the "Update Series" lectures and also to participate in the important research at their world class facility in Provo, Utah. He is also developing new techniques and materials to better restore endodontically treated teeth, including the Endo-Restorative Casting. He can be reached at drclark@microscopedentistry.com.

Disclosure: Dr. Clark is the owner of Bioclear Matrix Systems.