

Predictable, Conservative Closure of Black Triangles

A simple technique to treat this increasingly prevalent issue with confidence

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For years, many dentists have been fearful of treating “black triangles.” The loss of interproximal bone and papilla is one of dentistry’s biggest challenges. In a population increasingly fixated on appearance, black triangles are a real problem—one some dentists have shied away from treating because they lack a predictable treatment option. But with recent advancements in materials and the use of a simple technique, black triangles can be treated in a conservative fashion that achieves a beautiful, long-lasting result.

A black triangle is the space or gap seen at the cervical embrasure below the contact point of some teeth where the gum is missing (Figure 1). The main determinant of the interproximal papilla height is the underlying bone crest (ie, osseous peaks).¹ Research shows that the distance from the base of the contact area to the crest of bone correlates with the presence or absence of the interproximal papilla. When the distance is less than 5 mm, the papilla completely fills the interproximal space almost 100% of the time, but when the distance is 7 mm or greater, the interproximal space is completely filled in only about 25% of the time.²

In addition to recession and bone loss, another significant contributor to black triangles is adult orthodontics. In recent years, some have estimated that adults now account

for nearly 40% of all orthodontic patients.³ A higher acceptance rate in today’s adult population suggests a better understanding of the importance of oral health and a desire to achieve a more youthful, attractive smile. Unfortunately, in approximately 38% of adult orthodontic cases, black triangles result after orthodontic treatment.⁴

The presence of black triangles can leave these patients self-conscious and unhappy with their smiles. Treatment options such as bone grafting and papilla reconstruction are unpredictable at best, and indirect restorations, including veneers and crowns, are not a conservative option due to the aggressive nature of the required preparation. To get the proper emergence profile, the practitioner must prepare through the interproximal contact and extend beyond the lingual line angles, removing excessive amounts of tooth structure. Some have tried traditional bonding techniques to fill these open embrasures, but this can become too cumbersome to manage.

With no predictable options, fear has left many dentists reluctant to treat black triangles, but because their prevalence is increasing, these practitioners must find an acceptable, conservative technique that allows them to overcome their fear and treat this unsightly condition. To help clinicians feel comfortable

and confident enough to undertake these cases, this article presents a simple, conservative technique for closing black triangles that involves little investment or risk.

Case Presentation

A 42-year old, female patient, who had recently completed full orthodontic treatment, presented to the office with the chief complaint that the treatment had left her with large, anterior maxillary and mandibular black triangles (Figure 2). She stated that she felt embarrassed and consciously made an effort not to smile. After a consultation with a well-respected periodontist, it was determined that surgical intervention was not a viable option and that a restorative alternative was needed in order to achieve an acceptable result. The patient felt that doing nothing was not a choice.

On her Kois dentofacial risk assessment form, the patient reported that she “would like to change the appearance of her teeth,” and that she “felt uncomfortable or self-conscious about the appearance...” If left untreated, this would constitute a disability, and by this measurement, due to her lip mobility, tooth/gum display, and papilla loss, it would also leave her at high risk with a poor prognosis. Therefore, at that time, closure was completed on the black triangle between her



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(1.) Preoperative photograph of black triangles between teeth Nos. 22 to 27.

maxillary centrals using a conservative technique that will be described in further detail in the following treatment of her mandibular black triangles.

Approximately 3 years after maxillary black triangle closure, the patient returned to discuss closing her persistent mandibular black triangles. At this time, the measurement from the interproximal contact to the crest of bone ranged from 7.5 to 8 mm. This measurement, paired with the length of time that she had been out of orthodontics, suggested the papilla was never going to fill in on its own. Having already experienced the predictability of this procedure, the patient was excited to proceed with treatment to close her lower black triangles (ie, teeth Nos. 22 to 27) (Figure 3 through Figure 5).

Case Workup

In order for this technique to be successful, preparation is essential. It is important to have a discussion with the patient about his

or her chief complaint and expectations prior to treatment. Pre- and posttreatment photography with a quality camera is beneficial because it aids in patient education throughout the treatment planning process, serves as a lasting record of pretreatment conditions, and may be used to showcase treatment options to orthodontists. If a patient wishes to bleach his or her teeth, it is imperative to do so prior to black triangle closure. To achieve optimal bond strength and shade matching, all whitening must be completed 14 days prior to treatment. Bond strength can be reduced by as much as 25% if bonding is performed within this 2-week period.⁵ Finally, finances should be discussed. Typically, the fee for each black triangle closure is about 50% of a crown fee, so the procedure is not only less aggressive, but also more cost-effective.

Pretreatment Protocol

On the day of treatment, a specific pretreatment protocol should be adhered to. First,

a shade should be taken of the teeth being treated as well as a composite try-in of different shades, if necessary. Like most patients who receive this treatment, the patient in this case had undergone whitening treatment, so a bleach enamel shade of composite (Tetric EvoCeram® and Tetric EvoFlow® in bleach shades medium and light, Ivoclar Vivadent) was selected. It's important to select a composite with a significant chameleon effect that allows it to blend with the surrounding tooth structure.

A dry field is a must for composite bonding. If no medical contraindications are present, an antisialagogue should be given to reduce salivation. An anesthetic should be administered to reduce patient discomfort during the procedure. If a lingual bar is present, it must be removed along with any composite used to bond it. Following removal, the clinician must check for mobility and make a plan for posttreatment retention (ie, replace the lingual bar, fabricate a removable retainer, etc). Finally, a well-sealed rubber dam is placed that extends two teeth posterior from where black triangles are being closed.

Treatment Protocol

One of the keys to this technique is its simplicity. The treatment protocol can be broken down into the following three simple steps.

Clean

With the dam in place, it is imperative that the teeth to be bonded are cleaned thoroughly of all tartar, plaque, stain, and biofilm. To simplify this task, ideally, the patient should be seen for a cleaning appointment 1 to 2 weeks prior to treatment. Scalers should be used to remove any visible tartar/biofilm buildup, and a polishing point (Brownie®, Shofu Dental Corporation) is useful in removing any residual composite left from a lingual bar because it will not remove enamel. Next, an air abrasion unit set to 40 PSI is used over all tooth surfaces to be bonded. After a disclosing solution is painted on the teeth (Figure 6) and rinsed (Figure 7), the operator can see any areas that need further scaling and air abrasion to ensure that the teeth are completely biofilm free. Finally, a slurry of wet pumice is used with a rubber point, followed by a soft prophyl cup, over all of the surfaces. Now the teeth are completely clean, pristine, and ready to be bonded (Figure 8).



FIG. 2



FIG. 3



FIG. 4



FIG. 5

(2.) Postorthodontic/prebonding retracted photograph. (3.) Preoperative full-face photograph. (4.) Preoperative smile photograph. (5.) Preoperative, retracted smile photograph showing lower anterior black triangles and postoperative result of upper black triangle closure.

Bond

Using a matrix with built-in curvature and adjustable length (BlueView™ VariStrip™, Garrison Dental Solutions) facilitates the placement of a direct composite on the interproximal tooth surface that adds a gentle convexity from the contact point to the root surface below the free gingival margin in the sulcus. This creates an ideal shape, a highly polished surface, and a smooth interface at the gingival margin.

The first step in bonding is to place the matrix around one of the central incisors

while making sure to adapt the strip properly to the tooth (Figure 9 and Figure 10). The matrix needs to fit snugly in the gingival sulcus, intimately on the lingual-cervical at the gumline, and extend up into the contact area interproximally. Once the matrix is correctly positioned, the tooth is prepared to bond.

Because air abrasion was used to clean the tooth prior to bonding, preparation with a bur is not necessary. In adhesive bonding, using air abrasion in combination with acid etching achieves maximum bond strengths to

enamel and dentin.⁶ Using a total-etch technique, inject 37% phosphoric acid inside the matrix on both the mesial and distal aspects and agitate it gently with a long brush for 15 seconds (Figure 11).

After rinsing it thoroughly with water to ensure that all of the etchant is removed, lightly air dry the preparation (do not desiccate) and then apply a total-etch, single component adhesive (OptiBond™ Solo Plus, Kerr Corporation) to the enamel/dentin surface. Massage it into the tooth for 15 seconds, air thin it for 3 seconds, and light cure it for 20



(6.) Disclosing rinse applied to show biofilm. (7.) Biofilm remaining following rinsing of disclosing solution. (8.) Thoroughly cleaned and pristine teeth, ready for etching. (9.) Facial view of matrix in place. (10.) Lingual view of matrix in place. (11.) Tooth etched and bonded with a small amount of flowable composite placed. (12.) Condensable composite injected into flowable composite.

seconds. This adhesive was chosen because of its predictable high bond strengths to both enamel and dentin.⁷

After light curing the bonding agent, the tooth is ready for composite placement. Inject a small line (ie, 2 to 3 mm) of flowable composite just lingual to both the mesial-facial and distal-facial line angles and tease it incisally with an explorer. Following this, immediately inject the condensable composite interproximally into the previously placed, uncured flowable composite on both the mesial and distal (Figure 12).

Next, composite instruments are used to smooth out the composite and remove any excess (Figure 13). Once the composite is properly adapted within the matrix, it is gently pinched (not pulled), being careful to keep the matrix seated on the lingual aspect and interproximally in the sulcus, and then light cured (Figure 14). This step is critical in preventing significant interproximal overhangs. To finish, a small flash of composite is left on the buccal and lingual aspects (Figure 15 and Figure 16). It is suggested that practitioners wait to do final finishing until all composite has been

applied. The remaining lower anteriors were all subsequently bonded in a similar fashion.

Finish and Polish

The finishing process is started with the use of discs. Using the existing tooth structure as a guide, both large and small contouring and polishing discs (Sof-Lex™, 3M) are used to finish the composite to the tooth (Figure 17). Next, a fine, long flame-shaped diamond bur is used dry to aid this process on the buccal aspect, keeping the bur in the long axis of the tooth (Figure 18). On the lingual aspect,



FIG. 13



FIG. 14



FIG. 15



FIG. 16



FIG. 17

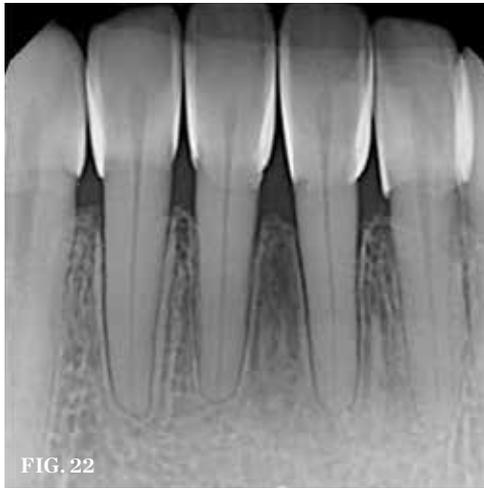


FIG. 18



FIG. 19

(13.) Instrument used to condense composite interproximally and adapt it to the facial line angles. (14.) After the composite is carefully adapted, the matrix is gently pinched before light curing. (15.) Facial view of teeth Nos. 24 and 25 after bonding, showing composite flash. (16.) Incisal view of teeth Nos. 24 and 25 after bonding, showing composite flash. (17.) Finishing with disc. (18.) Finishing with long, flame-shaped diamond bur. (19.) Finishing with mosquito-shaped, fine diamond bur.



(20.) Finishing with sharp Brownie point. (21.) Final polish achieved with polishing cups. (22.) Postoperative periapical x-ray image. (23.) Postoperative full-face photograph. (24.) Postoperative smile photograph. (25.) Postoperative, retracted smile photograph. (26. AND 27.) Pre- and posttreatment side-by-side comparison.

a 7404 carbide bur is used to remove flash in the cingulum area and lingual concavity. Next, the gingival margins on both the buccal and lingual aspects are marginated using a #12 scalpel blade (Bard-Parker®, Aspen Surgical).

When necessary, a mosquito-shaped fine finishing diamond bur is used wet with a light, deft touch, being careful not to gouge the root surface (Figure 19). This is done with extreme care. Following this, a sharp polishing point

(Brownie®, Shofu Dental Corporation) is used wet with a gentle touch over all accessible composite margins (Figure 20). Final polishing is completed using polishing cups (Figure 21), and floss and an x-ray image are used to check for any gingival overhangs (Figure 22). Although the tissue will be slightly irritated from the finishing process, it will heal completely within a few weeks. The result is both seamless and beautiful. (Figure 23 through Figure 25).

Conclusion

So, why should a dentist try this technique? There are many reasons that dentists elect to perform new procedures—all of which stem from trying to do what is in the best interest of their patients. Because the technique described here is additive and not subtractive, there is little risk associated with this procedure, and its conservative nature does not prevent the patient from choosing more aggressive indirect treatment options at a later date. For this patient, this procedure was truly life changing, which shows just how important it is for clinicians to overcome any fears they may have and continue to learn new techniques to address their patients' concerns in the most predictable, conservative way possible. 🦷

References

1. Castelnuovo J, Sonmez AB, Kois J. Titanium-reinforced interdental peaks as a simple method for papilla preservation. *Compendium*. 2004; 35(8):556-577.
2. Tarnow D, Magner AW, Fletcher P. The effect of the distance from the contact point to the crest of bone on the presence or absence of the interproximal dental papilla. *J Periodontol*. 1992; 63(12):995-996.
3. Kurth JR, Kokich VG. Open gingival embrasures and orthodontic treatment in adults: prevalence and etiology. *Am J Ortho Dentofacial Orthop*. 2001;120(2): 116-123.
4. Tanaka OM, Furquim BD, Pascotto RC, et al. The dilemma of the open gingival embrasure between maxillary central incisors. *J Contemp Dental Pract*. 2008;9(6):
5. Haywood VB. *Tooth Whitening: Indications and Outcomes of Nightguard Vital Bleaching*. 1st ed. Hanover Park, IL: Quintessence; 2007.
6. Roeder LB, Berry EA, You C, et al. Bond strength of composite to air-abraded enamel and dentin. *Oper Dent*. 1995;20(5):186-190.
7. Kimmes NS, Barkmeier WW, Erickson RL, et al. Adhesive bond strengths to enamel and dentin using recommended and extended treatment times. *Oper Dent*. 2010; 35(1):112-119.