



# CONSIDERING A PAPILLA REGENERATION TECHNIQUE

Closing a Diastema with Direct Composite

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## INTRODUCTION

### Esthetics and Diastema Closure

Many esthetic procedures that we routinely provide can actually improve the structural integrity of the tooth and also facilitate better health of the surrounding gingiva. Diastema closure, at least in the anterior sextant, rarely gives either of these secondary benefits. Unfortunately, the esthetic diastema closure often results in significant compromises in the root/crown architecture, and increased plaque retention with subsequent deterioration in periodontal health and poor “pink” esthetics.<sup>1</sup>

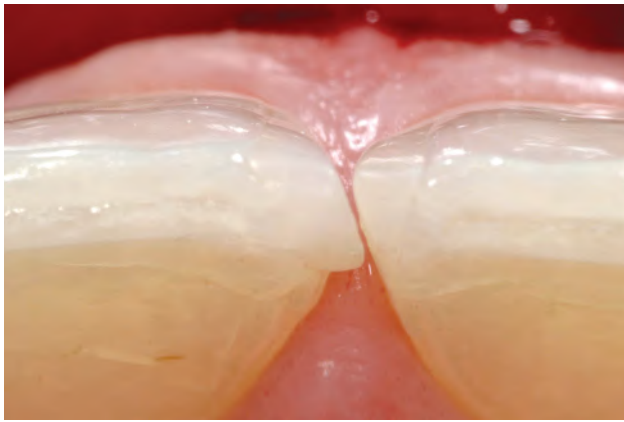
Number of total teeth planned for treatment	If > 4, the skill and patience of the operator will dictate the composite/porcelain decision.
Incisal edge to be lengthened?	If yes, the skill and patience of the operator will dictate the composite/porcelain decision.
Is papilla regeneration desired?	If yes, direct composite combined with a cervically pre-curved matrix is advantageous.
Is the color of the tooth/teeth acceptable?	If no, consider internal or external preoperative bleaching.
Cost considerations	Porcelain laminates could carry a fee two to four times that of the direct composite.
Previous restorations	Previous restorations involving extensive incisal areas favor porcelain re-restoration.
Tooth proportions	A diagnostic wax-up and a review of the AACD <i>Smile Design Criteria</i> will be helpful.

**Table 1:** Diagnostic work-up.

Unfortunately, the esthetic diastema closure often results in significant compromises in the root/crown architecture.



**Figures 1 & 2:** Preoperative views demonstrate several symmetry and ledge problems common with placement of direct composites to correct a midline diastema.



**Figure 3:** Preoperative incisal view highlights another common midline problem featuring a poor palatal-facial embrasure shape; most of these failures can be traced back to matrixing technique dilemmas.



**Figure 4:** Preoperative palatal condition. The significant ledge on the left central is even more apparent. In this case, 1.5 mm of gingival retraction occurred with placement of a well-punched and well-cuffed rubber dam.

The case discussed here demonstrates a classic iatrogenic diastema closure. It was then re-treated, featuring new strategies and being mindful of the myriad problems associated with traditional direct composite treatment of diastemas. The outcome is compared to the treatment of the lateral incisors which underwent simultaneous replacement of failing porcelain laminates with new porcelain laminates. Papilla regeneration should be considered any time that a diastema is closed, as open gingival embrasures (black triangles) do more damage than just prematurely age the smile; they also encourage accumulation of food debris and excessive plaque. In contrast to earlier thinking, we now understand that black triangles can adversely affect the periodontium.<sup>2</sup>

Considerations in treatment planning of diastema cases are outlined in **Table 1** (page 71).

#### Diastema Closure Using Composite Resins

When patients request that large diastemas be closed, alternative choices should always be discussed. However, patients will sometimes choose the most expedient option, such as direct composite. When faced with this challenge, we have limited options.

Until now there have been few techniques available to the clinician that provided a reasonable chance for success. There is a smattering of published techniques performed by some of the masters.<sup>3</sup> In the past there were three options:

**Option 1: No Matrix:** In the severe diastema case featured in this article, it appears that the previous clinician used the papilla as the gingival matrix on the left central incisor (**Figs 1-4**). It resulted in an adequate physical space closure but a biologically horrific contour. A sharp 90° angle, and a lumpy and porous surface combines for the worst environment for soft tissue health.

**Option 2: With Matrix, With Wedge:** The problem with traditional clear Mylar strips is that they are flat and require wedging, do not conform to the tooth, and are nearly impossible to maintain deep in the sulcus. The result is often an esthetic compromise. Holding all four ends of the strips and simultaneously light-curing is always a challenge.

**Option 3: With Matrix, Without Wedge:** This approach can yield the worst of all possible worlds—incomplete space closure and a gingival overhang.

## Case Presentation: Diastema Closure Combined With Papilla Regeneration

### Chief Complaints

The 32-year-old female presented for treatment with chief complaints of bleeding gums, brown stain, floss shredding, and incomplete direct composite diastema closure in the interproximal area of #8 and #9. The patient desired complete diastema closure and resolution of the above-mentioned problems. She also complained of discolored porcelain laminates and dark gingival margins on lateral incisors #7 and #10. All four incisors had been treated previously to close diastemas. As is typical with traditional direct composite techniques that rely on Mylar strip matrices, the previous composites did not have adequate cervical curvature to close the gingival half of the embrasure, much less to provide a “scaffold” for papilla regeneration.

### Treatment Options

A plan including pre-prosthetic orthodontics to evenly distribute the spacing followed by porcelain laminates was presented to the patient. As part of a comprehensive treatment plan several other options were proposed to the patient, including removal of the offending composites and return to the natural diastema; orthodontic treatment alone; a mixed case of direct compos-



**Figure 5:** Old composite has been removed and all surfaces blasted with pressurized sodium bicarbonate spray. No tooth preparation is needed when a total etch technique is utilized.

ites for the central incisors and porcelain laminates for the lateral incisors; and, finally, porcelain laminates for #5 through #12. The patient declined the comprehensive approach and was provided with information to give informed consent regarding the esthetic compromises before beginning treatment. The patient opted for retreatment of the central incisors with direct composite and retreatment of the lateral incisors with porcelain laminates.

### Treatment

Preoperative views (Figs 1-4) demonstrate many of the typical limitations and problems associated with diastema closure treated with the direct composite approach. They are as follows:

- black triangle remaining
- ledge that creates periodontal compromise and snags floss
- incorrect midline symmetry
- incorrect angulation of midline in gingivo-incisal inclination
- incorrect midline in palato-facial inclination
- light or “point” contact area.

The author has observed that the majority of cases that have presented in his office after these treatments have unacceptable contours, compromising the

periodontal health of the affected teeth. Research has shown that prosthetic marginal discrepancy greater than 50  $\mu$  will cause untoward tissue response.<sup>4-7</sup> Overhangs in direct materials demonstrate similar periodontal breakdown.<sup>8</sup> A large percentage of the diastema closures currently being treated with direct composites can have marginal ledges exceeding 500  $\mu$ . If we are to “do no harm” as we embark on elective diastema closure, we must elevate our game.

As the case progressed, the old composite was removed with a coarse flame-shaped diamond. In order to adequately remove biofilm, the teeth were painted with disclosing solution and then meticulously sprayed with a pressurized sodium bicarbonate/water mix (Fig 5).

### Use of a Rubber Dam

Rubber dam utilization is often dismissed for anterior esthetics as being unnecessary or, worse, counterproductive. The author has observed in most cases that the amount of interproximal gingival retraction afforded by the rubber dam is ideal for predicting the amount of static tension needed to generate or regenerate a papilla.<sup>9,10</sup> Immediately before matrix placement, application of an astringent

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**Figures 6 & 7:** Low- and high-magnification views of pre-curved dedicated diastema closure matrices fully seated. Note how the rubber dam aids in pressing the matrices against the teeth.

is accomplished with aluminum chloride (Hemodent; Philadelphia, PA) underneath the dam and a small contra-angle disposable brush. The astringent is massaged with the brush into the sulci, which provides an ideal control of crevicular fluids for up to 15 minutes. Once the rubber dam is removed, the tissue rebounds and the papilla shape is generally ideal.

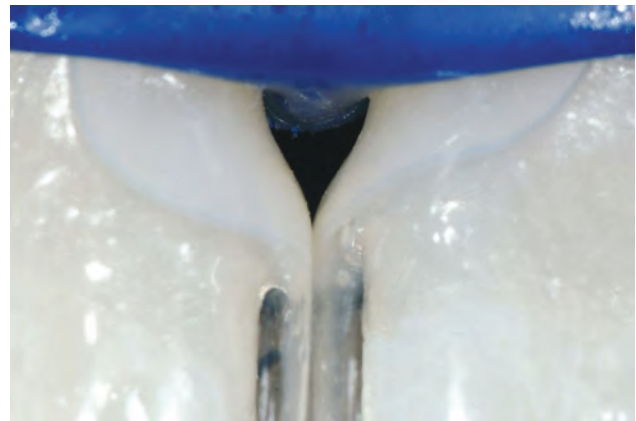
Two dedicated diastema closure matrices (Bioclear matrix DC-201; Tacoma, WA) were inserted inciso-gingivally until the gingival aprons of the matrices were near the depth of the sulcus (Figs 6 & 7). The rubber dam and/or gingival sulcus and/or gentle approximating devices such as a Wedget (Coltene/Whaledent; Mahwah, NJ) or Bioclear Interproximator provide sufficient lateral pressure to seal the gingival margins of the matrix. Use of a traditional wooden or plastic wedge during phase one of wedging must be eliminated to avoid deformation of a pre-curved matrix.

The teeth were then etched with 37% phosphoric acid, rinsed and dried, and a thin layer of bonding resin placed

and air-thinned but not cured. Then a small canula of flowable composite was angled into the interproximal from both the facial and the lingual aspects and a small amount of flowable composite was placed and then light-cured (Fig 8).

### Staged Wedging Technique

Once a small “hip” or undercut area of flowable composite has been placed and light-cured, an aggressive wedging force with a traditional wedge must be implemented to separate the teeth (Figs 9 & 10). For anterior teeth that are more easily displaced than posterior teeth, strong wedging pressure will generally compensate for the two sheets of Mylar in order to achieve a tight contact. Once

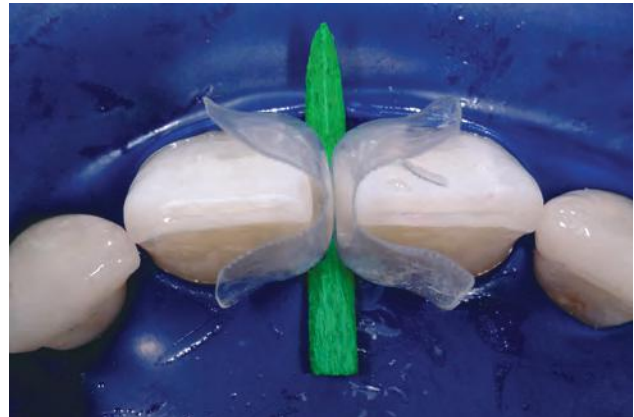
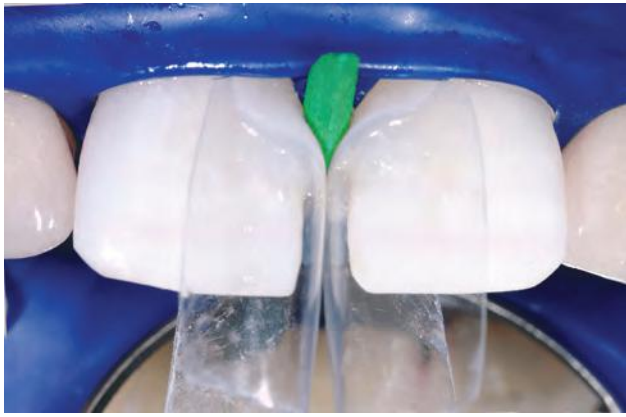


**Figure 8:** The first increment of flowable composite was placed and light-cured.

the teeth are wedged, the remainder of the space is filled with paste composite and then light-cured (Figs 11 & 12).

### Cervical Curvature

The key to ideal papilla regeneration in the diastema closure procedure—whether performed with porcelain or composite—is to provide aggressive cervical curvature that begins subgingivally.<sup>11</sup> Many traditional diastema treatments achieve closure with composite



**Figures 9 & 10:** Facial and incisal views of the second step of staged wedging.



**Figures 11 & 12:** Low- and high-magnification views after injection molding the second phase of the composite restorations.

or porcelain that reaches mesio-distally; “on top” of the gingival; or, as in the failed initial treatment of this case, in mid-tooth. These maxillary central incisors were retreated using the Bioclear DC-201 matrix. The bi-concave gingival contour of the matrix provides a shape that has heretofore been predictably created only by using porcelain as the restorative material.<sup>12</sup> Most importantly, it allows predictable deflection of the soft tissue to accomplish subgingival alteration of the emergence profile. The aggressive cervical curvature transitions to a fairly flat shape in the incisal two-thirds of the matrix. The immediate postoperative image (**Fig 13**) demonstrates the significant difference that a double concave pre-curved matrix can provide. The regenerated papilla completes the space closure and the static tension of the gingiva against the interproximal tooth surfaces provides a youthful seal, eliminating bacte-

rial colonization and debris accumulation. Vertical striations, which manifest themselves as modified specular highlights in the composite, were placed to minimize an excessively wide look to the central incisors.<sup>13</sup>

## Outcome

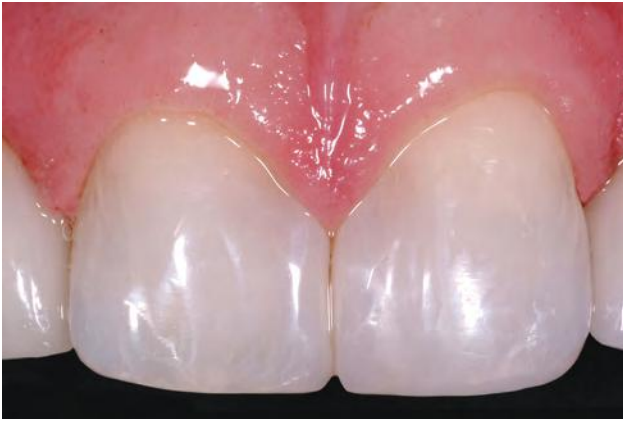
### Patient’s Reaction

The patient was extremely pleased with the result. The function and health of the midline contact were certainly improved and immediate papilla regeneration was fairly spectacular. The patient reported three important improvements: elimination of the dark space, elimination of food impaction, and reduced plaque accumulation. The highly polished composite surface attracts less plaque than the previous large embrasure space and actually felt smoother than her natural tooth surfaces.

### Clinician’s Assessment

Assessment of the case included the following criticisms:

- As is often the case with large diastemas that are treated without pre-restorative orthodontics, the final height-to-width ratio of the central incisors was not ideal (teeth appear slightly too broad); the patient was warned about this when she chose a limited versus a comprehensive treatment plan. The patient did not agree to have the teeth lengthened, which could have improved the height-to-width ratio.
- There is a slight color discrepancy between the flowable composite and the cervical enamel; however, the match becomes much better in the coronal two-thirds of the tooth. The paste component, Filtek Supreme (3M ESPE; St. Paul, MN) Body shade is fairly opaque and matches well with the 3M flow-



**Figure 13:** Immediately after treatment.



**Figure 14:** Three weeks postoperative with the more natural "wet look."

able composite which, at this time, is available in only one type of opacity. Currently there are limited options for flowable composite in terms of color and translucency, although many more flowable composites are being developed.

In retrospect, a more translucent and/or lower-value flowable composite could have been chosen for the cervical fourth; however, this can create more problems than it solves because of

the interproximal should be addressed first, the rubber dam removed, and then problems such as facial abrasions or additions to the interproximal composite be addressed as a separate step. The rubber dam has been an asset in the gingival-interproximal but a liability in gingival-mid tooth. Filtek Supreme Plus Flowable is one of the most opaque and most consistent with the corresponding body shades of paste composite. A similar case (but

precludes it from wrapping through the interproximal area to the palatal line angle.

## Summary

This article highlights a clinical case that demonstrated many of the common problems associated with direct composite treatment of midline diastemas. The patient was retreated successfully with a minimally invasive

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the challenges inherent in placing different shades of direct composites in a dedicated diastema closure matrix. In the grand scheme of things, once the teeth are rehydrated and viewed with lower magnification the color discrepancy becomes fairly minimal (**Fig 14**). To remedy this problem in this case, the composite could be re-roughened with a medium-grit diamond, the enamel and composite re-etched, and the transition could easily be softened with a thin skin of cervical composite extending to mid-tooth. The author, the developer of the matrix used in this case, recommends that

with more translucent composites) was discussed last year in *Oral Health* and provides an excellent contrast to the opacity of the composites used in this case.<sup>12</sup>

The three-week postoperative image (**Fig 14**) shows reasonable esthetics for both the central incisors treated with direct composite, and the lateral incisors treated with porcelain laminates. The occlusal view (**Fig 15**), however, demonstrates a healthier palatal contour for the direct composite and a more fully regenerated papilla as well for the direct composite approach. The inciso-facial path of insertion of a porcelain veneer

approach that included careful placement of composites using ideal tissue retraction, balanced use of flowable and paste composites, the staged wedging technique, and pre-curved/dedicated diastema closure matrices. Porcelain laminates are often considered to be superior to direct composites for treatment of diastemas. This case, however, demonstrates that direct composites can be superior to porcelain in terms of gingival health and for potential papilla regeneration.

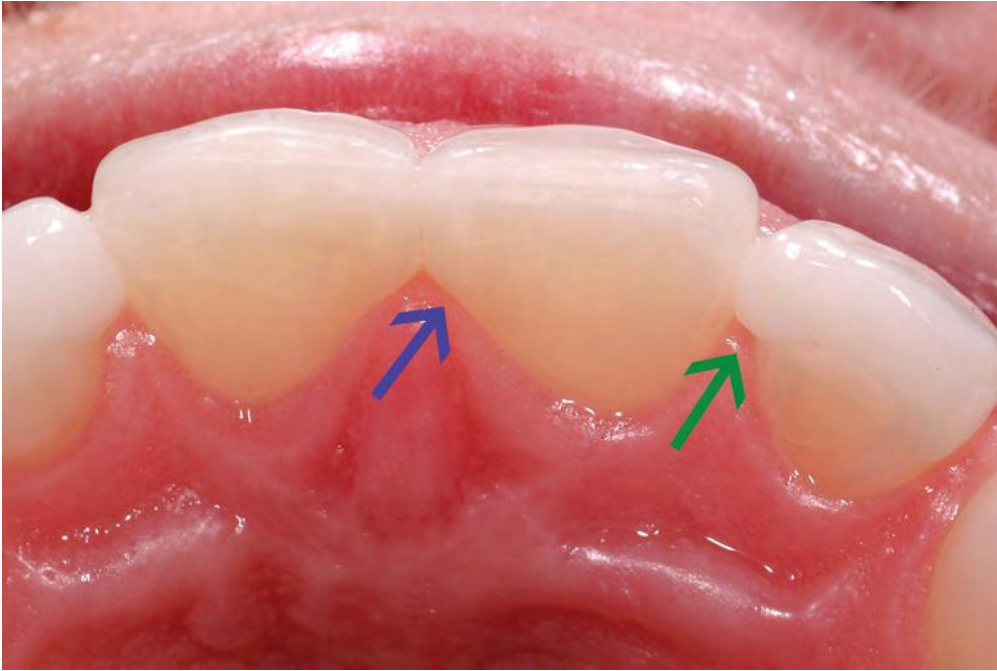


Figure 15: The blue arrow highlights the favorable “wrap” of the direct composite past the line angle of the tooth and favorable engagement of the palatal gingiva. The green arrow highlights the compromise that is typical with porcelain laminates for diastema closure with a more limited engagement of the palatal gingiva. This area will have higher potential for bacterial accumulation and less potential for ideal papilla regeneration.

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Dr. Clark graduated from the University of Washington School of Dentistry in 1986. He practices in Tacoma, Washington.

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