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## COMPOSITE VS. PORCELAIN'S: WHAT YOU NEED TO KNOW

*David J. Clark, DDS*

**DTO**   *Books*

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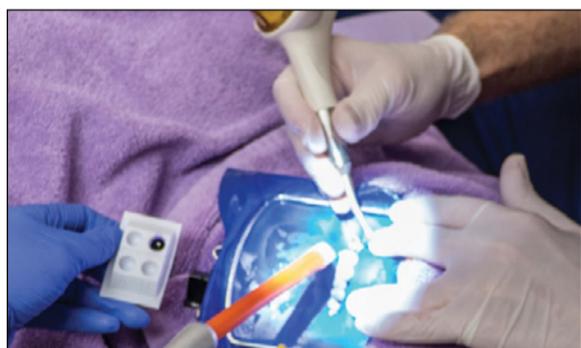
Direct composite restorations have a new role in new applications in conservative aesthetic dentistry.



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## DAVID J. CLARK, DDS

**ABOUT THE AUTHOR**



**Dr. David Clark** 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 also 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 micro dental instrumentation, imaging, and dental operatory design. Dr. Clark has authored several landmark articles about microscope dentistry including “Aesthetic Dentistry,” “Sealants,” “The Role of Ultrasonics in Three Dimensional Shaping and Restoration of Non Vital Teeth,” “Micro-Imaging and Practice Management,” and “Crack Diagnosis.” He is proud to join with CRA (Clinical Research Associates) in the “Update Series” lectures and to participate in the important research at its world class facility in Provo, Utah. He was the editor in chief for the 2005 launch of *The Journal of Microscope Dentistry*. He is one of the pioneers of the microscope in restorative dentistry and was the first to install ceiling tracks to facilitate the use of a microscope in more than one operatory. And, he is the owner of Bioclear Matrix Systems. He can be reached at [drclark@microscopdentistry.com](mailto:drclark@microscopdentistry.com).

# Chapter 1

## Young Patients and Fractures

**I**njection overmolding of teeth using the Bioclear Method<sup>1</sup> is changing the way that we *do* composite restorations, and more importantly changing the way that we *think* about restorative dentistry. (A short video showing the clinical steps of case 1 is available at the Bioclearmatrix website, YouTube, and in the *Dentistry Today* [web video](#) library.)

### CASE 1

*If you think only porcelain, not composite, can permanently restore an incisal edge, think again!*

In the first case (Figures 1 to 4), we see a series of photographs of a peg lateral restored with injection overmolding. Because it is monolithic and injection-molded (not hand-layered), it looks as smooth and beautiful as a porcelain crown in the 5-year follow-up photo (Figure 5). Furthermore, because properly injected composites can be thinned down to a 20- to 30- $\mu$ m gingival margin, the health of the soft tissues and aesthetic pinkness is better than it would look next to a less-than-perfect porcelain margin (Figure 6).

Now before we go any further, the reader should note that this author also uses porcelain and gold to restore teeth. However, after 22 years of microscope-enhanced ceramics, I have observed that the soft-tissue response of a 200- $\mu$ m ceramic margin is no match for a 20- $\mu$ m infinity edge composite margin.<sup>2</sup> And many crowns done today have open margins of 1,000  $\mu$ m or more, CAD/CAM or not. And no, resin cements don't "close" the margins. Porcelain is an excellent choice in many situations, but is no longer the only choice, nor always the best choice today, in the new world of monolithic injection overmolded composites.

### CASE 2

*If you think that patients don't mind having their teeth ground down for porcelain, think again!*

One of the worst things we can do to a young maxillary incisor is to place a

full-coverage crown. By the second or third go-round, there is almost no tooth left. In this case, we see the tragic state of affairs 20 years after the maxillary central incisors were restored, re-restored, and re-restored again with ceramic crowns; all following a traumatic incident accident in this patient's college days (Figures 7 and 8). Originally, he experienced incisal-third fractures of teeth Nos. 8 and 9. Remember that we cut up to about 72% of the tooth away when we do a *conservative* full-coverage ceramic crown. And with each retreatment throughout the decades, this poor patient's teeth just get smaller and smaller. When the patient, Dr. Mark Konings, experienced yet another failed

**Table. Achieving the New Super Strong Overmolded Composite Restoration**

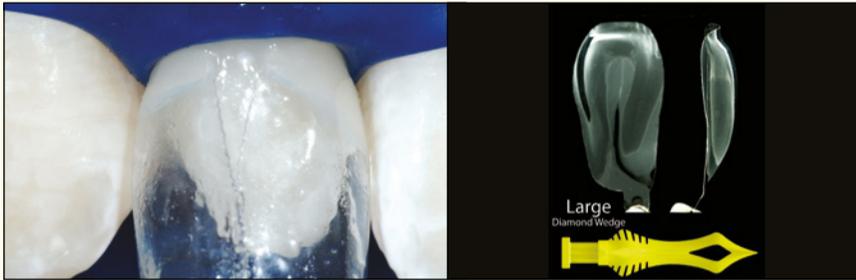
<b>Placement Technique</b>	Instead of hand spatulation and layering to grade on the incisal edge ("grade" is the native or planned additive final contour of the external of the tooth; it is a landscaping term adapted for restorative dentistry), intentional excess is injected against the tooth-Bioclear Matrix complex, similar to pressed porcelain, and the injection zone is then ground back to grade similar to milled porcelain.
<b>Incisal Thickness Inciso-Gingivally</b>	1.5 mm minimum
<b>Incisal Thickness Bucco-Lingually</b>	2.0 mm minimum

set of crowns, he came to me with this dilemma. Even though the treatments were done carefully each time by skilled and caring clinicians using state-of-the-art techniques, the eventual outcomes were not good ones. Throughout the years, the crowns on the upper arch wore down the enamel on the lower incisors, and subsequently ground down some more by his dentist to make clearance and draw to place porcelain veneers. Those preps were mostly in dentin at that point, and almost into the pulp.

The treatment for case 2 involved opening the vertical dimension of occlusion (VDO) with a unique and straightforward technique that is taught in the level 3.2 course at the Bioclear Learning Center (Tacoma, Wash). I placed composite overlays on the blasted (with aluminum tri-hydroxide [Bioclear Blaster]), etched, and unprepared posterior teeth of the lower arch. Next, the

patient's maxillary lateral incisors were overmolded with Bioclear 360° direct composite resin veneers using two A103 Small Incisor Matrices (Bioclear) (one on the mesial and one on the distal) (Figures 9 to 11). Once the Bioclear 360° composite veneers were finished on the lower incisors, the crowns were removed (Figure 12), abutments strengthened (Figure 13; this technique is explained in the level 6.0 Bioclear Learning Center Advanced Micro-Endodontics course) then impressed (Figure 14), and photos were taken to allow the ceramist to easily match the layering ceramic to the composite. Replacement of the crumbling and mostly de-bonded lower veneers was done in the same manner, with Bioclear 360° overmolded composite veneers and, because the VDO had been opened, I had the luxury of not grinding yet another 2 mm off of the patient's already beat-up lower incisors. Because the lower teeth lacked natural contacts once the veneers were removed, the treatment of the lower arch with composite overmolding was significantly more challenging than the maxillary lateral incisors. Because Mark was distraught about all of the

**CASE 1**

**Figure 1.** Pre-op view of a peg lateral. Approximately 7% of the population has a peg or undersized lateral incisor. A heavy rubber dam created an ideal environment to retract the soft tissue and to seal the margins of the Bioclear matrices.





**Figure 2 and 3.** Two Bioclear DC-202 matrices were placed, and the initial "hips" of flowable composite placed, approximately 2.0 mm in height. After light curing, delayed wedging using the atraumatic Diamond Wedges was done.

**Figure 4.** Immediate post-op view of the peg lateral showing a "porcelain-esque" density and polish to the monolithic composite.

**Figure 5.** A 5-year follow-up photograph demonstrates that injection overmolded composites can stand the test of time, even when restoring incisal edges.

**Figure 6.** Pre- and post-op radiographs of a typical peg lateral treated with injection molding of composite with a Bioclear DC-201m matrix.

**CASE 2**







**Figures 7 and 8.** Preoperative view of the chipping maxillary crowns and crumbling lower porcelain laminate veneers. It all started 20 years ago with 2 chipped teeth.

**Figure 9.** In contrast to "amputative" dentistry, additive dentistry was done. Note how the two A-103 Small Incisor Matrices (Bioclear) also served to control the placement of the 37% phosphoric acid gel etchant.

**Figure 10.** The lower incisors are shown here after injection molding and before A-103 matrix removal.

**Figure 11.** Bioclear Matrix Selection chart.





**Figure 12.** Once the failing porcelain was removed, the expected yet tragic tooth volume condition was noted.

**Figure 13.** The teeth have had ferrule resurrection and *frustum* preparations that will significantly reduce the risk of snap-off fracture by redistributing the stresses.

**Figure 14.** Pressed lithium disilicate (IPS e.max [Ivoclar Vivadent]) crowns were cemented (RelyX Luting Plus [3M]) after blasting the prepared teeth with gentle aluminum tri-hydroxide and a Bioclear Blaster.

**Figure 15.** Final postoperative view of the mixed composite/porcelain case demonstrating predictable and simple color matching.

loss of tooth structure, directly resultant from the dentist's decision to grind his front teeth down decades before, he was insistent on doing the least invasive approach, and he did *not* want additional ceramic restorations. Therefore, the challenge of managing Bioclear Matrices without the aid of natural contacts was met, albeit with logistical complexities.

In the final postoperative view, one can see the match between the maxillary central incisors restored with pressed lithium disilicate crowns (Shade A-2) (IPS e.max [Ivoclar Vivadent]) crowns, cemented with a resin modified glass ionomer cement [RelyX Luting Plus [3M)]; and overmolded composite on teeth Nos. 7, 10, and 22 to 27 (Figure 15). Monolithic composite resin (Filtek Supreme Ultra [3M]; A-2 body shade) was used with 90% of the volume in regular (paste) composite and approximately 10% Filtek Flowable (3M). A properly warmed (HeatSync [Bioclear]) composite resin will flow into the nooks and crannies and gingival margin areas where the matrix-tooth interface is at too acute of an angle to reasonably inject room temperature paste composite.

We cannot turn back the clock and undo what we did 20 years ago. Today is a new day! In this case, the patient realized that the next likely step for his tiny lower incisors was to grind them down to make clearance and draw to receive all-ceramic crowns, which was his only real choice using traditional means. He understood, because of his high dental IQ, that he faced the real possibility that the next failure would cause him to lose all of his lower incisors. And his 2 maxillary incisors were right behind them in this legacy of "amputation" dentistry. Dentists are afraid to change. And we love porcelain. In the author's opinion, when a patient walks into the office today with a fractured incisor, injection overmolding using a composite resin should be a first choice when indicated, not a full-coverage ceramic crown.

(An interesting side note on our patient in case 2: Dr. Mark Konings has a PhD in chemistry, is an expert in composite chemistry, works for 3M, and is a faculty member of the Bioclear Learning Center, helping to teach the very techniques that we utilized to help save his badly damaged dentition.)

#### If You Think Composite is Weak, Think Again!

Most dentists are shocked that the compressive strengths of monolithic (same material, nonlayered) lithium disilicate ceramic and monolithic composite are essentially the same. It does not make any sense, at first, because we see so many anterior composites that chip, break, and stain. The truth is that traditional composites are weak because *they are made weak* using outdated



**Figure 16.** Drs. David Clark and Mark Konings shown teaching at Bioclear Learning Center.

placement techniques.

At the Bioclear Learning Center, the principles and fundamentals of anterior tooth reconstruction are taught that render a composite resin restoration nearly as bulletproof as the new strong, monolithic all-ceramics. Composite's fracture toughness (3 point bend) is less than porcelain; however, and therefore, the placement techniques employed require strict adherence to the parameters found in the Table.

With the Bioclear method, there should be little to no hand manipulation of the composite. Instead, a balance of heated flowable and heated paste composite is injected into the tightly fitting and anatomically shaped Bioclear matrices. Because the matrices are surprisingly thin at 50  $\mu$ m, tight contacts are possible without wedging. Most dentists are pleasantly surprised that there is rarely an overhang created in the interproximal. This is due to the tight fit and precise adaptation of the matrix, combined with the ideal controlled injection pressure of heated flowable composite plus heated regular (paste) composite.

To fully understand the global implications of the composite versus ceramics debate, the reader needs to understand a few key issues. First, prosthodontists have traditionally steered the thinking of the dental schools and private teaching institutes toward what is considered "permanent" and away from what is "temporary." For example, if you take advanced coursework at many of the established institutes in the United States, they are usually run by a noted prosthodontist. These courses are organized, carefully thought out, and well taught. However, they are ceramic-centric. Most prosthodontists have very little confidence in composite resins as a 20-year modality. Not surprisingly, the few composite courses that they offer are either fussy artistic layering courses (where you spend 6 hours to build a central incisor), or sometimes discussing

the use of composite as a temporary fix while you wait to do the “real thing” (ie, an all-ceramic restoration). At our learning center courses, we often welcome prosthodontists (as attendees) who are intrigued by the role of composite as both a permanent and transformative dental material.

The second key issue is that dental clinicians in the rest of the world (other than the United States and Canada) often tell me that North Americans “mutilate” teeth and “throw crowns at nearly every tooth” we see. Clinicians in Europe, South America, Asia, and elsewhere place far fewer ceramic full-coverage crowns and a lot more composite resin restorations. Why? Several reasons. Most of the rest of the world does not have an insurance-based model for reimbursement. In the United States, we are rewarded when we do a crown because the insurance fee is generally 4 times higher for a crown—approximately \$1,000 for a crown versus \$250 for a composite. If you take insurance out of the picture, the composite resin option becomes far more important. Habit is also at work in the overall makeup of clinical choices being made. Europeans do significantly more large composites in lieu of crowns and therefore hone their skills. And they take pride in being conservative. Europe’s biggest problem is an obsession with layering that creates a weaker, more porous, and more expensive composite than necessary. In the end, Europe’s composite resin restorations (due to complicated placement techniques) are leaking, staining, and breaking, *just like ours*.

## CLOSING COMMENTS

Whenever I give a hands-on course, I like to start with the following story:

A 12-year-old girl accompanied her mother and her dentist to an AGD sponsored all-day hands-on course teaching the Bioclear method. The mom had asked me if it was okay for them to attend the course with their doctor. Well, I did her one better! When the course was ready to begin, I handed the young girl a dentoform, matrices, instruments, a composite heater, and said, “Do the exercises and have fun.” At the end of the course, the 12-year-old girl brought her dentoform for me to critique her 3 exercises. How do you think she did? She knocked it out of the park! Modern composite techniques, such as the Bioclear method, can be easy to learn if you forget pretty much everything that you have been taught, start over, listen carefully, study basic engineering, and follow directions exactly. And, it can be just as profitable as placing all-ceramic restorations.

It may be quite some time yet before mainstream dentistry learns and adopts modern composite technique. However, a small and rapidly growing segment of dentists internationally are embracing this patient-friendly and predictable technique. Due to word of mouth, an online presence, and information via other media, patients are beginning to ask for the Bioclear method. Perhaps it will be patient demand that will jumpstart this new revolution in conservative patient care?♦

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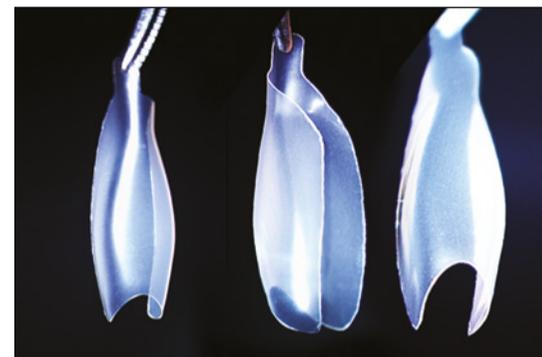
# Chapter 2

## The 360° Composite Resin Veneer

Should full crowns be a last choice when considering reconstruction of anterior teeth today, rather than a first choice? In Figure 1, we see a catastrophic failure of a ceramic crown done using a “conservative” crown preparation design. Magne and Belser<sup>1</sup> have demonstrated the extreme tensile stresses present in the palatal cemento-enamel junction (CEJ) area *in a virgin incisor* when the tooth is loaded. Any axial reduction in the palatal CEJ area is crippling to the maxillary tooth because the already high stresses naturally present in this area are greatly multiplied. This is a problem even when the axial reduction is minimal; ie, 0.5 mm. Throughout time, with constant masticatory function, stress corrosion occurs in the palatal dentin until eventually the crown can suddenly snap off at the gumline. This results in an irretrievable failure in most cases with the need for a subsequent extraction. Ask yourself, how would you feel if your central incisor snapped off today *at lunch*?



**Figure 1.** A catastrophic snap-off failure just 8 years after what appears to be a conservative axial reduction prep had been cut. (Image courtesy Dr. Jihyon Kim, Mercer Island, Wash.)



**Figure 2.** Bioclear 360° veneer matrix. Currently sold as a 6-tooth kit (12 matrices), the notched gingival portion allows deeper seating and is comfortable to the patient.



**Figure 3.** Before and after images of a now-happy patient.



**Figure 4.** Monolithic Overmolded Composite restorations contrasted with the before image of “patchwork” composites.

### THE DIRECT BIOCLEAR360° COMPOSITE VENEER/CROWN

The Bioclear Matrix System was introduced in 2007. A Diastema Closure Matrix process patent and a Restoratively Driven Papilla Regeneration patent were granted by the US patent office in 2013. The Injection Molding Process patent was granted in 2015 by the US patent office to overmold teeth with a balance of heated flowable and heated (regular) paste composite.

The original Bioclear Matrix is remarkably strong in spite of only being 50 µm thick. This gauge of mylar (which is the same as old-fashioned, flat mylar strips) is popular for anterior composites such as Class III restorations, closing diastemas, treating undersized and peg laterals, and eliminating the “dreaded black triangle” present in 30% of adults and probably 75% of

post-ortho adult cases. The many shapes and sizes allows for a wide variety of applications. The ultrathin width of

these matrices allow for a tight contact without using wedges in many cases.

The next generation of the Bioclear Matrix is significantly stiffer. The Bioclear Veneering Matrix is 75 µm and is as strong as stainless steel (Figure 2). It comes in a kit with a paired 2-part (mesial and distal) matrix that snaps around anterior teeth to allow easier reconstruction of teeth when no diastemas or large black triangles are present. It comes in a 12-piece, canine-to-canine kit. The anatomic shape allows the matrix to seat easily into the sulcus without bleeding. Interproximal scallops account for the presence of the papilla (patent pending). Heated composite is injected into the forms once the tooth has been prepared. Preparation of the tooth involves blasting off biofilm, lightly sanding the contacts with True Contact



**Figure 5.** Retracted preoperative view demonstrating multiple aesthetic problems.



**Figure 6.** Oblique view shows the rotated lateral incisor that needed to be reduced on the mesial aspect. (Note: This was the only area that required aggressive reduction.)



**Figure 7.** Occlusal photograph reveals that we had ample space on the central incisors to add enough thickness of composite resin to successfully hide the dark color of the teeth without amputating tooth structure.



**Figure 8.** Filtek Supreme Ultra (3M) (shade B1 body) was placed on the tooth for patient shade approval. Remember to keep the teeth wet during this time to avoid color confusion. Also, make certain the composite is light cured before showing the patient, as most composites get brighter after curing.



**Figure 9.** The old restoration has been removed from just the one incisor. This allows me to not lose the landmarks and have trouble later with symmetry and midlines.



**Figure 10.** The set of Bioclear360° Veneer matrices was seated and trimmed.



**Figure 11.** The 37% phosphoric acid was injected into the forms and was well controlled during etching and rinsing.



**Figure 12.** Incisal view of the completed injection shows a palatal and facial “umbilical cord” (intentional composite resin excess) that was left undisturbed until after light curing.



**Figure 13.** Facial view of the intentional excess.



**Figure 14.** Once the right central had a rough shape, the left central incisor was disassembled and restored.

sanders, and removing any decay and/or old restorative material. There are several unique advantages to both the patient and the clinician (Table 1).

**CASE REPORT**

A female patient presented for her new patient examination recently. She was referred by her daughter, Sarah, who is an excellent hygienist in our office. The patient was on a limited budget and requested that 2 of her old and yellowing composite resin fillings be replaced. After reviewing her photographs with her, at the consultation appointment, I suggested that replacing old fillings alone was not going to make a significant impact on her overall smile (Figures 3 to 5). Instead, I recommended 5 Bioclear360° veneer restorations. It should be noted that orthodontics and porcelain reconstruction were also discussed with the patient, but she declined those more extensive, expensive, and invasive options.

**Clinical Protocol**

The first step of the procedure was to determine if any prominent areas of the

<b>Table 1. The Bioclear360° Veneer Versus Porcelain for Anterior Teeth</b>	
<b>No tooth structure needs to be removed for path of insertion</b>	Draw is needed to seat porcelain. This results in up to 75% of the volume of tooth being cut away.
<b>Single-appointment restorations</b>	Patients must return for a second appointment unless the doctor has a milling machine. If the doctor has a milling machine, the milled veneers cannot be made as thin as pressed veneers, requiring heavy tooth reduction.
<b>Composite can be thinned to a 20 µm infinity edge at the gingival margin</b>	Many porcelain crowns and veneers cause mild gingival inflammation resulting in unaesthetic red or cyanotic tissue. Marginal gaps of 200 to 1,000 µm are the norm.
<b>Most composites wear at the same rate as enamel</b>	Porcelain is more abrasive than enamel, and during a lifetime, it takes its toll on opposing natural teeth.

<b>Table 2. Injection Overmolded Composite Versus Traditional Composite</b>	
<b>Bioclear360° Overmolded Veneers/Crowns</b>	<b>Hand-Layered Composite Veneers</b>
Compressive strength of monolithic composite is nearly as strong as milled lithium disilicate (IPS e.max [Ivoclar Vivadent]).	Layering, especially hand layering, creates a phenomenon described as “seaming,” which creates an inherently weaker restoration.
Stain resistance is excellent, but a minimum of training is key to achieve the super shine evident in the post-op photos.	Hand-placed composites often look acceptable on the day of placement, but are notorious for stain. After a few months, interproximal margins all begin to stain.
The Bioclear Method is now being requested by patients.	Direct bonding has a bit of a bad name. Check out what dentists and patients say about it on the Internet.

teeth would need to be sacrificed to be able to create uniform coverage with composite resin. In this patient’s case, the mesial of the right lateral needed to be reduced (Figures 6 and 7). I generally use shade B1 body Filtek Supreme Ultra (3M) for most cases, which can be seen in Figure 8 being tried in and light cured



**Figure 15.** The Bioclear HeatSync unit. This warming unit creates ideal thermal liquefaction of composite heated to 155°F.



**Figure 16.** Postoperative view reveals an ideal smile architecture as the smile-line follows the shape of the lower lip.



**Figure 17.** Postoperative oblique view.



**Figure 18.** Retracted postoperative view with the ideal combination of pink and white: healthy pink tissue, minimal amputation of tooth structure, and ideal shapes that eliminate black triangles.

on the tooth for patient approval. Next the teeth were disclosed (Bioclear dual-color disclosing agent) and then blasted carefully to remove biofilm (Bioclear Blaster). Minor bleeding often occurs during this procedure, and this can be easily controlled with the use of Astringent (Ultradent Products). Old restorations were removed and all sharp areas were rounded. Long bevels are also helpful. Incisal edges can be predictably restored if certain guidelines are followed. (See part 1 of this ebook, which outlines the requirements to predictably restore incisal edges with composite resin.)

Next, the teeth were restored one at a time to achieve tighter contacts (Figures 9 to 14). Intentional excess was left at the injection zones, while the critical interproximal and sgingival areas needed little to no finishing. Each tooth had a gross shape, but final shaping was done with coarse discs (Sof-Lex ET [3M]). Finally, the 3-step polishing technique was done to achieve a mirror finish that rivaled porcelain for brilliance. ([A brief narrated video of the procedure is posted on YouTube, the Bioclear Matrix website or at the Dentistry Today website. It is titled "Bioclear360° Veneer."](#) Details of the 3-step "rock star" polish are also in this video [Table 2]).

#### HEATING OF COMPOSITE AS A FOUNDATIONAL ISSUE

When I first began injection molding of composite, I suffered needlessly with cold composite resin. It adapts poorly to the tooth, distorts the matrix, and leads to overhangs and huge voids. Nearly everyone utilizing the Bioclear Method who has made the move to warming the composite resin (Bioclear HeatSync)

raves about the benefits realized by doing this additional step (Figure 15). Simply put, to make composite resin as predictable as porcelain, *heating is a must.*

Heated composite has been around for a long time now, nearly 20 years. Until we started injecting composites recently, there was no real urgency to use heating. Now it is a must. Composite is safe to the pulp and soft tissue because composite acts like a thermal insulator. It has low specific heat, like popcorn. It can be very hot, but it doesn't burn you. On the other hand, metals have high specific heat. That is why any heating of metal instruments that are to be used in the mouth is to be avoided.

#### WHAT IS THE SCIENCE BEHIND THE BIOCLEAR METHOD?

There was recent research showing that the Bioclear Method was significantly faster than the Mylar Pull Technique and resulted in 100% of the samples with an ideal contact, versus only 80% with the Teflon technique.<sup>2</sup> Additionally, there are multiple studies demonstrating that composite can be heated for extended periods without any negative affects to the composite.

Final views of the case show the mixed porcelain and Bioclear360° Veneers smile. A common sight: the composite teeth have tissue that is healthier, pinker, and prettier than tissue near the porcelain margins<sup>3</sup> (Figures 16 to 18).♦

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# Chapter 3

## Modern Management of Deep Caries

**D**r. G. V. Black mandated in 1890 that all caries must be removed. All state and regional examinations for dental licensure in North America will fail the applicant if any caries is left before restoring the tooth. But is this actually state of the art today? *Absolutely not!*

### SELECTIVE CARIES REMOVAL: THE NEXT BIG THING

For the past 125 years, teeth with deep caries likely required the operator to end up with a carious pulpal exposure. There were countless stressful “dance with the devil” episodes as we got as deep as we dared to remove as much caries as possible, all done *without* exposing the pulp. Multiple studies have shown that caries need not be treated as we have done until now.<sup>1</sup> Herald the new era of *selective caries removal*. In the past, some attempts were made at partial caries removal, in which the deep caries was left undisturbed, a temporary restoration was placed, and then reopened months later to do final caries removal and final restoration. This procedure has never been a mainstream procedure for several reasons. First, it required 2 separate invasive procedures with associated morbidities and multiple appointments, and these are never popular with patients. Second, the temporaries often fell out, requiring joyless and profitless babysitting. Third, it placed stress on the dentist, because if there was a pulpal exposure on the second appointment, it was disappointing to both patient and doctor. Fourth, the fee for the sedative filling was generally not commensurate with the time and complexity involved to do the procedure justice. In truth, it was a procedure mostly done in dental schools and low-fee clinics, not private practice. Fifth, and to add insult to injury, many insurance companies have stopped coverage for pulp capping.

### What Is the Modified Hall Technique?

At the Bioclear Learning Centers (locations in Tacoma, Wash, and Solihull, England, UK), we have incorporated the Modified Hall Technique as part of the curriculum in Level 4.0 as a mainstream procedure that is elegant, patient friendly,

predictable, and profitable. In other countries, such as Ireland and others in the United Kingdom, this has been the standard of care for decades. (Note: The new rules go beyond the scope of this article, and the reader is encouraged to attend a learning center course or lecture or webinar.) The quick summary is that the procedure is an “outside-in”<sup>2</sup> approach with the creation of a 1.5- to 2.0-mm clean margin. Simultaneously, all of the caries at the dentino-enamel junction (DEJ) *must be* removed. The Original Fissurotomy Bur (SS White) is an ideal instrument for this new task of aggressive removal of caries at the DEJ, leaving healthy dentin and enamel on the cavosurface side of the bur and selective caries retention on the inside part of the preparation. The Standard Hall Technique was the traditional 2-appointment technique. The Modified Hall Technique, as we have coined the term, is a single appointment; a one-and-done procedure where the selectively retained caries will become hard, dried out, and essentially sterile via the nourishment and multiple healing factors infiltrating from both the pulp cells and the odontoblasts.<sup>3,4</sup> Case selection is key. The pulp must be vital and the teeth asymptomatic.

### CASE 1

#### Anteriors: Catastrophic Soda Caries

Figures 1 to 4 demonstrate the dilemma of G. V. Black rules. Our patient had caries that extended near and likely into all of the pulp chambers of his teeth. He was a heavy Dr. Pepper drinker in the past but was committed to changing his diet and home care. His previous dentist had recommended removal of all of his teeth and dentures because he could not afford root canals, posts, and crowns on all of his teeth. Additionally, by the time all of the tooth amputation required for traditional porcelain and endo-centric dentistry was performed, there would be insufficient tooth structure to retain the crowns. One of the paradigm shifts of the Modified Hall Technique is that the carious dentin in the center of the tooth changes from a liability to an asset.

In Figure 5, the maxillary left central incisor demonstrates the ideal prep for this tooth and for injection overmolding. The reader is encouraged to visualize

how much tooth would remain after complete caries removal, endo access, and incisal and axial reduction for a full crown. The author would have cut away essentially everything left in this photograph. This case is striking because complete caries removal, endodontic access, and axio-gingival reduction for a porcelain crown would have, in sum, removed essentially all that was left of his teeth. And, the same nourishing features of the pulp/odontoblast complex that provide the healing of carious dentin also had kept his pulps alive and symptom-free in spite of the seemingly catastrophic caries present.

The patient's treatment of teeth Nos. 6 to 11 was spread out during 2 appointments and 2 calendar years because he was on a budget and was trying to maximize his insurance benefits, a problem for aesthetic matching of porcelain, but not for injection overmolding with Bioclear anatomic anterior matrices.

Figure 6 is a pre-op view of the right lateral incisor (tooth No. 7) with solid enamel in the gingival-facial area. That asset must be maintained, and only a featheredge reduction was performed there. Tooth No. 7 was

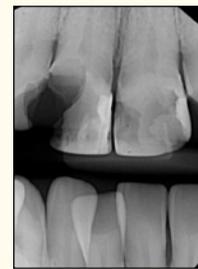
**CASE 1**



**Figure 1.** The patient, despite significant decay, had no pain in his teeth. Because the pulps were still vital, he was an ideal candidate for the Modified Hall Technique.



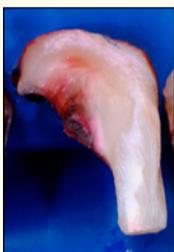
**Figure 2.** Post-op view demonstrates a life-changing transformation of his smile and countenance. The patient had no post-op sensitivity, and gingival tenderness disappeared quickly.



**Figure 3.** Pre-op radiographs. The primary goal of modern caries removal: 2.0 mm of clean margin and to never expose the pulp.



**Figure 4.** Post-op radiograph. The generous selectively retained caries was barely evident in the center of the tooth. Sometimes, it can be far more apparent on post-op radiographs.



**Figure 5.** The maxillary left central incisor demonstrates the ideal prep for this tooth and for injection overmolding.



**Figure 6.** Pre-op view of the right central incisor (No. 7). The solid enamel in the gingival-facial must be maintained. Only a featheredge reduction was performed there.



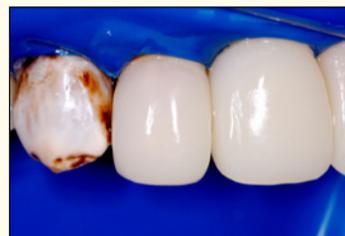
**Figure 7.** Tooth No. 7 was blasted to remove biofilm (Bioclear Blaster). All caries within 2.0 mm of the gingival margin was removed.



**Figure 8.** Tooth No. 7 has 2 Bioclear A-103 matrices in position with 37% phosphoric gel etchant (Scotchbond Universal Etchant [3M]). Bioclear matrices control/contain the gel, allowing coverage of the entire coronal aspect of the tooth.



**Figure 9.** Tooth No. 7, continued: A balance of heated, flowable, and paste (regular) composite has been injected into the forms. Teeth were individually prepped and overmolded.



**Figure 10.** The completed Tooth No. 7. A new 2-step polishing technique was used here (Bioclear Magic Mix Pre-Polisher and Jazz Polisher [SS White Burs]).



**Figure 11.** Patented Bioclear anterior matrices with multiple shapes and sizes shown. The A-103 matrices were used for tooth No. 7.

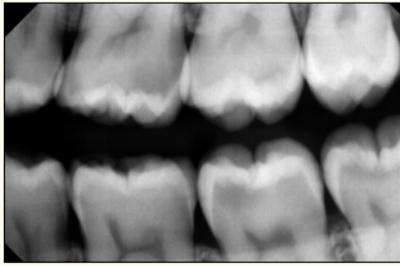


**Figure 12.** Equipment and materials for modern composite placement: Bioclear Blaster (for biofilm removal) and HeatSync Composite Heater (Bioclear).



**Figures 13 and 14.** Before and after photos.

**CASE 2**



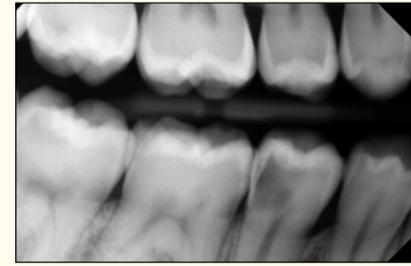
**Figure 15.** Pre-op radiograph shows widespread occlusal caries, even though sealants had been previously done.



**Figure 16.** Tooth No. 18 with selective caries removal; calla lily prep (cusp tip to cusp tip), clean (blasted) enamel at the infinity edge; absolute caries removal at dentino-enamel junction. Red stained caries can be opaqued (Opaquer [Pulpdent]).



**Figure 17.** Fissurotomy bur in position to prep stain and caries from grooves before selective caries removal. Exquisite external seal required to achieve high success rate (reported in scientific literature at 95%).



**Figure 18.** Pre-op radiograph showing extremely deep caries in tooth No. 29.



**Figure 19.** Post-op radiograph demonstrating the new look of the Modified Hall Technique. The ideal margin displayed on the distal of tooth No. 29 is only predictable with *deep margin acquisition*.



**Figure 20.** Deep marginal caries removed, soft tissue near the deep margins removed, and a rubber dam placed. A medium diamond wedge was placed ("pre-wedge"). The surface at center of the tooth was like a soft noodle dentin (left alone). Another application of caries indicator would have stained bright red there.



**Figure 21.** The new Bioclear Bicuspid Twin Ring Separator is shown. It will not collapse into the preparation; twin nitinol wires will not stretch out and lose force as traditional NiTi spring separators do.



**Figure 22.** Completed restorations. No pulpal exposures had occurred; no reported post-op sensitivity.

blasted to remove biofilm (Bioclear Blaster), and all caries within 2.0 mm of the gingival margin was removed (Figure 7). Once the preparation was complete, Bioclear A-103 matrices were placed into position and 37% phosphoric acid gel (Scotchbond Universal Etchant [3M]) was applied (Figure 8). The Bioclear matrices control and contain the etching gel, allowing coverage of the entire coronal aspect of the tooth. The goal of optimal modern composite placement is to avoid layering and hand manipulation of the composite whenever possible, so a balance of heated (to 155°F in a HeatSync Composite Heater [Bioclear]) flowable and regular composite resin (Filtek Supreme [3M]) was injected into the forms (Figure 9). It should be noted that while the compressive strength of monolithic Filtek Supreme is impressive at around 350 MPa, the diametral tensile strength is far less, so all incisal edges must be 2.0-mm thick. The teeth were prepped and overmolded one tooth at a time to maintain landmarks such as contact positions and axial inclinations. In this case, A-103 matrices were used for tooth No. 7. At only 50 µm, snug contacts can be created in many instances without a wedge. The snug apical fit of the matrix plus the power of heated flowable and heated creamy Filtek Supreme paste result in overhang-free margins with better marginal integrity and better tissue response than average crown margins.

After any needed occlusal adjustments, the restorations in this case were all polished using new 2-step polish technique culminating with the Bioclear Magic Mix Pre-Polisher and Jazz Polisher (SS White Burs) (Figures 10 to 12). ([This technique can be viewed in the video from the part 2 of this article series at dentistrytoday.com, and also at biomatrix.com.](#))

**Patient-Centered Versus Doctor-Centered Outcomes**

I have retreated many porcelain cases that looked fabulous at the 5-minute follow-up, some that have even won awards at cosmetic dentistry academies, which were catastrophic failures at only 5 or 10 years postoperatively. We must look down the road with our patients (quite a few of whom might live into their 90s and older) and bank all of the tooth structure that we reasonably can. Additive dentistry that is also outcome-based dentistry can be just as transformative to many patients as more traditional (and more invasive) porcelain-centric dentistry. Note the transformation of case 1 (Figures 13 and 14). The author has done many comprehensive porcelain reconstruction cases, but the new skills and materials required for this life-changing treatment put this as one of the author's proudest accomplishments.

#### What Material Should Be Placed Over Retained Caries?

In the author's opinion, *modern pulp capping is a microsurgical and natural healing event*, not a chemotherapeutic event. No disinfection of the retained carious dentin was performed in the study quoted above, and yet the success rates hovered around 95% for permanent and primary teeth. One probably cannot really sterilize a 2.0-mm pile of soft dentin. They did use resin modified glass ionomer, but the suggested healing action of the infected dentin was from the patient's own body, not from a bottle or tube of "magic" filling material. Bioactive materials may help dentin, but we don't know about their effect on carious/infected dentin. And, frankly speaking, with success rates at 95%, apparently all that we really need is well-trained hands and proper case selection.

#### CASE 2

##### Posteriors: Catastrophic Failed Sealants and Caries Into the Pulp

The young patient here contacted me from another state after her dentist recommended 9 root canals and crowns on her posterior teeth. Because she could not afford that treatment, her only choice was to have most of her back teeth extracted. In addition, it did not make sense to her mother that so many teeth would need root canals since the teeth were not painful. The mother did an Internet search on failed sealants and found one of my videos on YouTube. After a brief exchange of emails, the patient and her mother traveled to our Tacoma office for Modified Hall Treatment.

The preoperative radiograph showed the devastating occlusal caries that had occurred in spite of sealants having been done previously (Figure 15). Although the patient had the responsibility for follow-up care, she did not seek regular care; the sealants had given the patient a false sense of security.

According to G. V. Black's rules, the patient would indeed have needed 9 root canals. Instead, I was able to do the Modified Hall Technique and modern cavity preparations combining fissurotomy, calla lily, and overlay cavity preparations. The 16 posterior teeth were treated in a marathon 6-hour appointment. Nine of those teeth required the Modified Hall Technique.

The treatment protocol of tooth No. 29 is briefly described in Figures 15 to 20. (The actual technique was shot through the lens of a Global AG [Global Surgical Microscope]. This, in addition to the patient interview, can be viewed at the websites [dentistrytoday.com](http://dentistrytoday.com) or [bioclearmatrix.com](http://bioclearmatrix.com).)

#### CLOSING COMMENTS

New treatment modalities are constantly being developed that will support modern conservative dentistry. This is the current direction in some areas of dentistry, hopefully leading us all to more patient-centered treatments and outcomes. The challenge is to change paradigms and to learn new skills. Thankfully, today's practicing clinicians have the resources to get the proper postgraduate education and to implement their new knowledge and skills to the benefit of the patient. ♦

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