Introducing the Clark Class I and II Restoration

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Twenty-five years after their inception, posterior composites remain unpredictable. In comparison to amalgam restorations, posterior composites show significantly higher failure rates, are more costly, take longer to place, have more postoperative symptoms, leak, stain, chip and cause food impaction (Figs. 1-3). My former operative dentistry instructor (a legend in the Pacific Northwest) continues to build his legacy today at the University of Washington School of Dentistry. He recently shared this opinion with me—he “hates” posterior composites and hates to teach the technique. In this article, I will explore a technique that addresses the most serious shortcomings of posterior composite restorations.

WHAT’S WRONG WITH THIS PICTURE? Between 2005 and 2007, I lectured alongside Dr. Gordon Christensen and Derek Hein at the “CRA Dentistry Update.” A good cross section of restorative dentists from around the USA and Canada attend these lectures. At each city (and also at my private lectures) I have asked attending dentists (now numbering more than 6,000 clinicians) this question: “How many of you feel that posterior composites are holding up as well as amalgams?” Only a few hands go up. Over 95% have concluded that posterior composites are inferior to amalgams, yet most have stopped doing amalgam restorations and are placing posterior composites. Then I ask the attendees, “So if amalgams are better, why are we doing posterior composites?” The answers generally involve hand wringing, frustration, and lively debate.

Endodontists joke that posterior composites are the number one killer of pulps, that leaking composites are their “number one” referral source. Most studies have shown that Class I and Class II composites have a significantly higher failure rate than amalgam restorations.1-4 The AMA, ADA, FDA, US Public Health service, CDC, NIH, and WHO have all declared amalgam safe. In light of this evidence and overwhelming opinion, how can we in good conscience continue to place posterior composites? So let’s ask one more time, WHAT’S WRONG WITH THIS PICTURE? Why are we content to provide a posterior composite res-
oration that essentially cripples the tooth in the name of esthetics, knowing that there is no proven systemic health benefit compared to amalgam? Many restorative dentists have simply given up on amalgam and composite and spend more than $100,000 for a Cad Cam unit. They choose porcelain inlays and onlays as successors to amalgam rather than struggle and compromise with posterior composites.

The current state of posterior composite restoration poses empirical arguments for amalgam or porcelain alternatives. But by the conclusion of this article I will provide two very good reasons why posterior composites can bless, rather than curse the tooth.

THE G. V. BLACK ERA
To understand how clinicians can be influenced by a cultural and scientific icon, it is helpful to look at medical history. Claudius Galen was a Roman physician who boldly devised a medical model that doctors followed for fourteen centuries. Though his medical judgments were remarkably advanced for his day, today, not surprisingly, we know that most of Galen’s theories and treatments were completely wrong, and that the rest were seriously flawed. In a parallel to Galen’s example, G. V. Black was a consummate dentist/scientist and his exquisite designs for cavity preparation were a huge step forward for dentistry. Unfortunately, we are discovering today that those cavity shapes weaken the posterior dentition and lead to fracturing in even the most conservative applications\(^5,6\) (Fig. 4).

In a two-year study planned for future publishing; between 2001-2003 I utilized 16X magnification to evaluate each posterior tooth that was treated for replacement of an amalgam or posterior composite. I classified and documented incomplete fractures. I found:

- Most fractures initiate in dentin at the line angles
- Interrupted cavities were more crack resistant than connected cavity preparations

In 2004, I collaborated with Dr. Sheets and Paquette to publish the first guide to early and treatment of microscopic dentin and enamel cracks/fractures in the Journal of Esthetic and Restorative Dentistry. In the May 2007 edition of Dentistry Today, (“The epidemic of cracked and fracturing teeth”), I highlighted the widespread problem of amalgam tooth preparations that predispose the tooth to fracture. One of dentistry’s myths is that amalgam expansion causes tooth fracture. Expansion failures have never been proven. The fracture problem does not originate with amalgam, per se. It originates in iatrogenic GV Black cavity preparations. And just as many of us feared, we are seeing the same pattern of fracturing in teeth with posterior composites now that enough time has elapsed to assess their longevity.

THE SIMONSON TRANSITION
Dr. Richard Simonson is widely recognized as a pioneer in new cavity preparation shapes for minimally invasive, bonded, resin-based posterior composites. In spite of his innovations, the GV Black preparations that I was taught in school twenty years ago have been only slightly modified for posterior composites in the typical dental practice and in most dental schools.

FIGURE 1—What’s wrong with this picture? These recently placed posterior composites demonstrate the often woeful state of direct composite restorative dentistry. Black arrow: A carious fissure was missed; lack of magnification was the likely culprit. Blue arrow: “Minimally invasive” Class II cavity shape creates impossible C Factor problems. Red arrow: Incremental loading leaves seams and voids that allow subsequent fracture. Green arrow: Proximal tooth was iatrogenically gouged and now has a carious lesion penetrating into dentin.

FIGURES 2 & 3—are higher magnification views of Figure 1.
Table 1 highlights problems with traditional posterior composite techniques.

A flat metal matrix, traditional wedge, boxy cavity shapes, biofilm that is difficult to remove just past the margins and incremental composite loading combine to give the common result in figure 5. The Clark Class II shape, aggressive “sanding” of the interproximal with a lightning strip prior to placing the matrix, an anatomic, translucent matrix (Bioclear Matrix System) that allows the composite to form an ideal feather edge, and injection molded single phase composite placement combine for a superior result. (Fig 6, 7)

Composite is a poor biological space filler. A biological space filler such as amalgam or gold foil does not require any adhesion to the tooth surface. Composite on the other hand must be sealed 360 degrees and from inside to out.

Unlike amalgam and gold foil techniques, “packing composite into a hole” is not a predictable method. Excellent clinicians have been dealt an unfair hand when it comes to Class II composites. Most of the features of the traditional cavity preparations such as parallel walls, resistance and retention form work against posterior composites. What we have observed at CRA and under the microscope is that polymerization shrinkage cannot be eliminated, only mitigated. The best margin is no margin, and when composite extends slightly past the cavo-surface margin, it is generally well sealed with no white line. When we polish back to the mar-
gin, the white line often appears. “Composite sealing” with thin resins applied after filling the cavity may reduce wear. However, trying to seal an imperfect margin after the fact is futile. As I have explored these white lines, they generally extend completely to the pulpal floor, far beyond the reach of a sealer.

C factor has been oversimplified and remains a significant problem.

Posterior composites should go “on” not “in” the tooth.

Minimally Traumatic dentistry should be considered as an upgrade of “Minimally Invasive” dentistry. Well meaning dentists are promoting minimally invasive dentistry. The best long term outcomes are more important than the race to minimize the micrograms of tooth structure that are removed. For example, the tunnel preparation preserves the enamel of the marginal ridge but unnecessarily weakens the tooth and impedes clinical visualization. Incomplete caries removal combined with excessive tooth weak-

Table 2
The disconnected occlusal portion of the restoration can be:

- Small defects; Fissurotomy shaped;
- Moderate lesion; Cala Lilly shape
- Large sized lesion or amalgam replacement; cusp tip to cusp tip
- Splinting Cala Lilly shape
ening are unacceptable casualties of the noble mission to save marginal ridge enamel.

**THE FISSUROTOMY AND “CALA LILLY” CLASS I; THE CLARK CLASS II**

The fissurotomy class I, Cala Lilly Class I and the Clark Class II are fairly radical departures from GB Black’s system of preparing and restoring posterior teeth. These new cavity designs are based on adhesive composite restorative materials and engineered to resist tooth fracturing (Figs. 8A-C). The new primary goal of first-time interproximal caries restoration is to avoid connecting the occlusal to the interproximal, a concept that Simonson first advocated. The different sizes of the occlusal portion of the new Clark Class II cavity preparation are summarized in Table 2.

**A NEW FISSUROTOMY TECHNIQUE (OCCLUSAL PORTION):**

This new technique has five important components. First, the concept of “sealing over” caries and grossly contaminated pits and fissures is questioned, and replaced by exacting micromechanical instrumentation. Second, the size and shape of fissure preparation burs is completely modernized with the development of the Fissurotomy Bur System (SS White, Lakewood, NJ). Figure 9 contrasts the precision-engineered SS white Fissurotomy NTF Bur tip size with standard #556 fissure bur. The #556 is unfortunately the most utilized operative bur in dentistry and is largely responsible for the current “epidemic” of cracked teeth. Today my protocol involves the use of both the Fissurotomy Original Bur as well as the narrower Fissurotomy NTF Bur (Fig. 10). Fissurotomy Burs are scientifically developed instruments for the diagnosis and treatment of hidden caries and should be utilized to create proper preparation form and function for the placement of composite restorations. The Fissurotomy NTF Bur is ideal for ultraconservative micro preparations of pit and fissure defects. The thin carbide tip of the Fissurotomy Burs will not
“strip” quickly like thin diamonds. Third, each occlusal defect is addressed separately, wherein the clinician should avoid the temptation to “connect the dots.” Fourth, the restorative material of choice is a robust, filled composite such as a flowable composite and/or heated paste composite. Fifth, the use of advanced clinical magnification ranging from 3.5X to 16X is imperative.

The Calla Lilly (occlusal portion): The Cala Lilly, a beautiful trumpet shaped flower (Fig. 11). I use its name to describe the new cavity shape for medium to large sized Class I composites. Traditional parallel walled cavity preparations have not been shown to provide the adequate volume of enamel rod engagement. Compounding the problem is parallel cavity walls that do not afford proper angle of intersection of enamel rods to provide long term splinting of posterior tooth.

THE CLARK CLASS II (INTERPROXIMAL PORTION)
The goal of first-time interproximal caries restoration is to avoid connecting the occlusal to the interproximal, which is a concept that Simonson first advocated. The next evolution of this design is the saucer shape with serpentine/disappearing margins. The final change is discarding and replacing old filling techniques, matrixing systems and curing techniques.

Figures 12-19 demonstrate a clinical example of a combined Cala Lilly occlusal and Clark Class II interproximal. The beautiful first bicuspid in figure 12 is from a twenty-eight year old male. It shows an early incomplete coronal fracture, based on the magnified view of the mesial marginal ridge and according to the guide that we published in the Journal of Esthetic and Restorative Dentistry and most recently in Dentistry Today. Earlier in my practice, I would have turned this Class I (occlusal) amalgam one into a Class II or “MO” composite or amalgam, because I would not have seen the fracture undermining the buccal cusp that is not visible at less than 10X. In addition, I suspected but did not understand that turning this Class I into a traditional Class II with a mesial box form would further weaken this already iat-
rogenically compromised tooth. There is now a better approach, one that does not necessarily involve an indirect procedure such as a crown or onlay.

As we continue with the bicuspid in image 12, the occlusal is treated first, and a “Calla Lilly” shape that engages the bulk of the occlusal table is prepared and restored (Fig. 13). The Calla Lilly Class 1 will be explored in future articles. The interproximal is then addressed separately to simplify the process and to control C factor. Note the saucer shape on the mesial (Fig. 14). This flattened cavity shape requires a completely new filling protocol and peripherals. Instead of metal sectional matrix bands, wedges and separators, we utilize transparent anatomic sectional matrix bands (Bioclear Matrix System™), translucent Interproximators™ and a single load technique with an injection molded process where resin, flowable composite and then paste are loaded in sequence without stopping to light cure the individual components. The restoration is light cured with one or multiple curing lights from occlusal, buccal and lingual with this fully translucent system. The result is a seamless, rounded restoration that delivers breathtaking results (Fig. 15-17). Better is rarely faster in dentistry, but our test clinicians report both (better/faster) once they are past the learning curve.

One year post-operative view of the case is compared to the immediate post-operative view in figures 18 and 19. SEM analysis of in vivo wear is showing that the infinity edge margin has superior wear and stain resistance when compared with G.V. Black preparation, with or without a bevel. Interestingly, the infinity edge margin of the Cala Lilly occlusal preparation and the infinity edge margin of the Clark Class II saucer preparation both are showing better marginal integrity than that of porcelain inlays. In both comparisons, it is the resistance to marginal ditching of the infinity edge margin that appears to provide the advantage.

CAN THESE THINGS LAST?
Early posterior composites showed unacceptable wear. Microfills like Heliomolar had excellent wear resistance but mediocre strength. Marginal ridge fracture was common. Many modern composites now exhibit excellent strength and wear resistance. In several studies, composite/enamel bonding has exhibited very lengthy in vitro success that does not deteriorate over time.7 The key is that the initial bond must be exquisite and engage large areas of enamel, such as seen in enamel-based porcelain and composite veneers.

In another unpublished study, CRA scientists assisted me for an in office recall study. We documented patients with minimally traumatic Class I composite restorations that had been in service for three to seven years. In 107 posterior teeth, 100% of the composites were retained. Excess wear was present in some samples that utilized flowable composite alone. The combination paste/flowable cases showed the best wear resistance in SEM evaluation (Fig. 20) and slight staining was present in less than 5% of all samples.

POLISHING
The modern composite restorations described in this article are designed to be minimally traumatic, maximally esthetic, wear resistant and strong. The final leg of the journey is finishing and polishing. One of my favorite diamond impregnated polishers, the Shape and Shine by Clinical Research Dental (Figs. 21-23) provides the best control and shape for creating an unbelievable finish. Care should be taken in polishing not to create excessive heat, which actually “cooks” the composite and leaves a dull, weakened surface. One of the most important components of my composite hands on courses is the

**PULL QUOTE**

to be determined
shaping and polishing exercise. Most of us have never been adequately trained to achieve ideal composite finishes, and 90% of composite finishing systems sold today are either redundant or difficult to use.

SUMMARY
As we introduce the concepts summarized in this article to practicing dentists, they show a broad spectrum of responses from shock and disbelief to sheer exuberance. As these cavity shapes are implemented we will see a dramatic reduction in the rate of tooth fracturing. We also anticipate that these restorations will outlast the Class II amalgams that have served so well in the past. This very brief article can only touch on the dramatic differences of this minimally traumatic and incredibly durable direct composite. A full instructional DVD, together with a textbook and hands on courses are available and recommended. The Clark Class II and injection molded technique are intellectual property of the author patent pending and may be used solely with permission.

Disclosure
Dr. David Clark has financial interest in several of the products mentioned in this article. The Bioclear Matrix System, hands on courses, training DVD’s and fissurotomy burs and polishers are available through Clinical Research Dental at www.clinicalresearchdental.com and www.bioclearmatrix.com.

REFERENCES

10 GREAT REASONS
To launch a business to business advertising campaign
If you think the only reason to advertise is to keep your name out front or to generate a few sales inquiries, think again. Advertising, like any other marketing tool, must have specific objectives. And contrary to popular myth, most can be measured. How many of these objectives should be included in your next advertising plan?

1 CREATE AWARENESS. It's absolutely essential in today's volatile marketplace.
2 BUILD BRAND PREFERENCE. Low brand preference equals small margins.
3 KEEP CUSTOMERS SOLD. Guess who your competitor's best prospects are?
4 CREATE IMAGE. A positive one that is.
5 CHANGE IMAGE. Before it's too late.
6 BE NUMBER ONE ON YOUR PROSPECT'S NUMBER TWO LIST. That way you're the first one to be called when they change suppliers.
7 BE MORE VISIBLE THAN COMPETITORS. If your competitors have cut back on advertising ... opportunity knocks.
8 INTIMIDATE COMPETITION. Sounds fair to us.
9 INCREASE MARKET SHARE. Without having to buy it.
10 ANNOUNCE CHANGES. Or you could let the rumor mill do it for you.

YOU SUPPLY THE REASON WE'LL SUPPLY THE BUYERS