



Conservation Crisis

**When the Most
Conservative
Treatment Might
Not Be the Most
Appropriate
Treatment**

For years “minimally invasive” has been the watchword of clinical dentistry. In abstraction, it is arguably the guiding principle of ethical treatment planning. But no plan survives its first contact with the enemy, and clinical reality regularly presents situations where a minimally invasive approach is either impossible or even deleterious to long-term success. *Inside Dentistry* takes a look at the quandary of practicing minimally invasive dentistry when “ideal” meets “get real.”

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The Minimally Invasive Model

The principles of minimally invasive dentistry aspire to preserve the maximum amount of natural tooth structure when modifications are required, and replace it so that it mimics what was removed. A different paradigm from when GV Black espoused “extension for prevention,” minimally invasive dentistry as the presumptive standard of care evolved coincidentally as retention form principles could be eliminated, resistance forms could be diminished, and clinicians were presented with more options.

“If GV Black had our technologies, materials, and techniques, he’d have been practicing minimally invasive dentistry; he did the best he could with the materials he had,” says Mark Malterud, DDS, trustee of the Academy of General Dentistry and former officer of the Academy of Biomimetic Dentistry.

It’s generally agreed that the full thrust of more conservative treatment began with the advent and evolution of adhesive technology initiated with the introduction of etching enamel by Buonocore, explains Michael Sesemann, DDS, an Accredited Fellow and past president of the American Academy of Cosmetic Dentistry (AACD). With the evolution of composites and porcelains, restorative materials could be bonded to tooth structure, rather than mechanical retention. They also didn’t need to be thick and bulky for strength, as illustrated by bonding thin porcelain veneers to enamel from their advent in the 1980s to their zenith in the late 1990s through the first decade of the 2000s.

“Within one generation of dentistry, the landscape changed profoundly,” he notes.

The concepts spread to restorative dentistry, and instead of eliminating an entire occlusal surface for a metal restoration and implementing “extension for prevention,” dentists could remove only the area of decay, clean the remaining adjacent fissures, and restore the entire preparation with a methacrylate-based composite material; one formulation for larger cavities and a lower-viscosity material to conservatively infiltrate and seal the grooves.

“I don’t think any dentist is a maximally invasive dentist,” says Malterud. “More people are embodying the minimally invasive philosophy, which preserves as much tooth structure as possible, then builds the tooth back up to restore strength using today’s technology, techniques, and materials to where it can function.”

Essentially, restorative materials have evolved from occupying space to “fill” a void in a tooth to being bioactive, remineralizing, and protective. According to James DiMarino, DMD, MSED, director of clinical affairs for Premier Dental Products Company, materials can be considered “minimally” invasive or conservative if the decay they are used to replace is itself minimal. However, the only way decay can be minimal is if patients are using technology in conjunction with effective home care to prevent or reduce the progression of decay.

For cosmetic dentistry, minimally invasive concepts have come full circle since their early years, when composite bonding and bleaching were the main options available, explains Corky Willhite, DDS, an Accredited Fellow of the AACD and former member of the American Board of Cosmetic Dentistry. When porcelain veneers became popular, there was a trend away from being conservative, with more aggressive preparations accommodating the reduction required for porcelain build-ups. AACD Accreditation examiners were among the first to reverse this trend with guidelines discouraging aggressive preparations.

“The pendulum has swung back toward composites and conservative dentistry,” Willhite observes. “This has been reinforced with the advent of prepless porcelain veneers and biomimetic dentistry.”

This follows general trends in medicine, where minimally invasive procedures are preferred. Fortunately for dentists, adhesive materials and porcelain fabrication techniques have improved greatly in recent years, allowing for very thin, strong ceramics that can be bonded with high predictability. Aggressively removing tooth structure is no longer warranted or desired.

“Better informed and educated patients seek treatments that are not only esthetic, but are also innocuous, healing, and have a beneficial effect on their overall health,” notes Lynne Calliott, vice president of marketing, Americas, for Shofu Dental Corporation. “Minimally invasive dentistry is associated with thinking about a patient’s condition in a holistic versus atomistic way.”

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Re-establishing functional esthetics—as opposed to just providing “beauty dentistry”—is significant to achieving minimally

invasive results and long-term success. A challenge, however, is that clinical reality dictates what is possible and what is best. There are times when the most appropriate treatment may deviate from the “textbook” definition of minimally invasive or conservative treatment.

“Ultimately, as aggressive as you can get is extracting a tooth, but even then you can be minimally invasive,” Malterud asserts. “If you have flared roots and extracting the tooth would destroy massive amounts of bone, going in, sectioning a tooth, and taking it out in individual roots is very minimally invasive to the patient and the bone structure.”

Although a worst-case scenario, the point is that when embodying a minimally invasive philosophy, dentists are always looking at how to preserve the tooth, tooth structure, and surrounding structures when dealing with the case. Consider the need to complete endodontic treatment to acquire a post space for retaining a build-up and crown. At times, it is simply necessary. In addition, when the existing ferrule height is insufficient, crown-lengthening or orthodontic extrusion may need to accompany a full-crown preparation to provide the tooth structure resistance necessary for long-term success, Sesemann explains.

“A variety of presenting conditions can make a full-coverage crown the treatment of choice,” Sesemann adds. “Individuals with high cariogenic potential or teeth with biomechanical detriments can benefit greatly from full-coverage restorations, especially now that the thickness of our materials can be thinner.”

No-prep veneers are at times staunchly prescribed as much for the psychological impact on the patient as their actual physical benefit. On occasion, a limited amount of preparation can make a significant difference in the final esthetic result, and if the preparation does not penetrate the enamel, violate the dentinoenamel junction (DEJ), and/or disrupt a potential bond to enamel of the restorative material, there is very little detriment derived from minimal preparation, Sesemann adds.

Unfortunately, the reality of thin restorations is their limitation to a handful of situations, and they simply cannot be used exclusively due to various clinical scenarios, says John Weston, Accredited Fellow with the AACD and director of the Scripps Center for Dental Care. If the teeth are flared out or severely rotated, some tooth structure removal

must occur for proper smile design parameters and to enable realignment with the final veneers. Another scenario where some reduction might be required would arise when effecting a dramatic color change. A patient with dark teeth will require more space and possibly a deeper preparation to block the underlying color. Building out a thicker veneer restoration may also work, but is often not preferred.

Additionally, there are instances when adhering to minimally invasive techniques can potentially result in ineffective care and the need for retreatment. One example is the all-too-often presentation of a 9- to 12-year-old patient with bonded resin sealants placed 2 to 5 years earlier. Dark shadows can be seen around the margins of the sealant through the translucent enamel, and often an ominous radiolucency is seen on the bitewing radiograph.

"Sealants, when performed ideally, are perhaps the most minimally invasive treatment we have in restorative dentistry," says Theodore P. Croll, DDS, from Doylestown Pediatric Dentistry in Doylestown, Pennsylvania. "However, they cannot be placed 'willy-nilly' without extensively investigating the pits-and-fissures for hidden caries lesions. Like any other dental procedure, a complete diagnosis must be made before a definitive treatment—such as bonded resin sealants or preventive resin restorations—are prescribed."

"For me, personally, I have found it necessary to ensure that the grooves on the tops of posterior teeth are sufficiently prepared with either minimal preparation, particle abrasion, or both so that I can visually guarantee that the groove is clean and there is no extension of decay past the DEJ," says Sesemann, who notes that unsuccessful restorations are usually accompanied by a history of improper isolation and/or extension. "If I do that and complete my adhesive protocol under rubber dam isolation, the results are undeniable and the restoration will be in service for many, many years."

Weighing the Choices

When considering the long- and short-term approaches for treating the conditions presented to them, clinicians should first look to systematic literature reviews, note analysis, and conclusions. They can also conduct their own literature research using PubMed, because articles that appear there will be peer-reviewed; however, they should understand that just

being listed or peer-reviewed does not ensure scientific acceptance. Whenever possible, they can also use evidence-based dentistry websites, such as ADA.org and midentistry.com, says Mark Heiss, DDS, director of new business development, regulatory affairs, and professional relations at GC America.

"The ongoing shift to and popularity of evidence-based rationale for conservative dentistry helps to provide historical data showing that focusing early on prevention permits many dentists the opportunity to employ minimally invasive treatments using bioactive/remineralizing technologies," DiMarino explains. "This approach provides the best long-term prognosis for many patients while reducing the need for emergency, short-term solutions that tend to be more aggressive in nature, which thereby reduces long-term success rates."

Among the conservative materials that are available today is a low-viscosity resin that infiltrates early incipient smooth-surface and interproximal carious lesions, says Nathaniel Lawson, DMD, PhD, an assistant professor in the Division of Biomaterials in the Department of Clinical and Community Sciences at the University of Alabama, Birmingham, School of Dentistry. The material is particularly conservative, because there is no tooth removal necessary.

Glass-ionomer cements also have been shown to be ideal as minimally invasive restorative materials because they are biomimetic and bioactive, use both chemical and mechanical adhesion so there is less leakage, are erosion-resistant, and release beneficial ions, explains Heiss. Additionally, newer glass-ionomer materials can now be load-bearing due to improved compressive, flexural, and wear properties. They also demonstrate improved esthetics and translucency.

In general, a material could be defined as bioactive if it will form hydroxyapatite on its surface, or release calcium phosphate or fluoride, Lawson says. Several bioactive materials are currently available, but only in direct restoratives and cements (ie, not indirect restorations). In order for a material to be successful in the short or long term, it must be strong enough to resist bulk fracture, and for long-term success, an ideal material would release calcium, phosphate, or fluoride to help remineralize surrounding tooth structure experiencing secondary caries, he adds.

"Dental professionals are fortunate to

practice at this time, as modern materials are much more effective, conservative, and protective," notes DiMarino. "Smaller burs enable smaller preparations, which allows for greater retention of tooth structure. These small restorations can then be protected by remineralizing treatment gels to help prevent recurrent decay and further tooth loss."

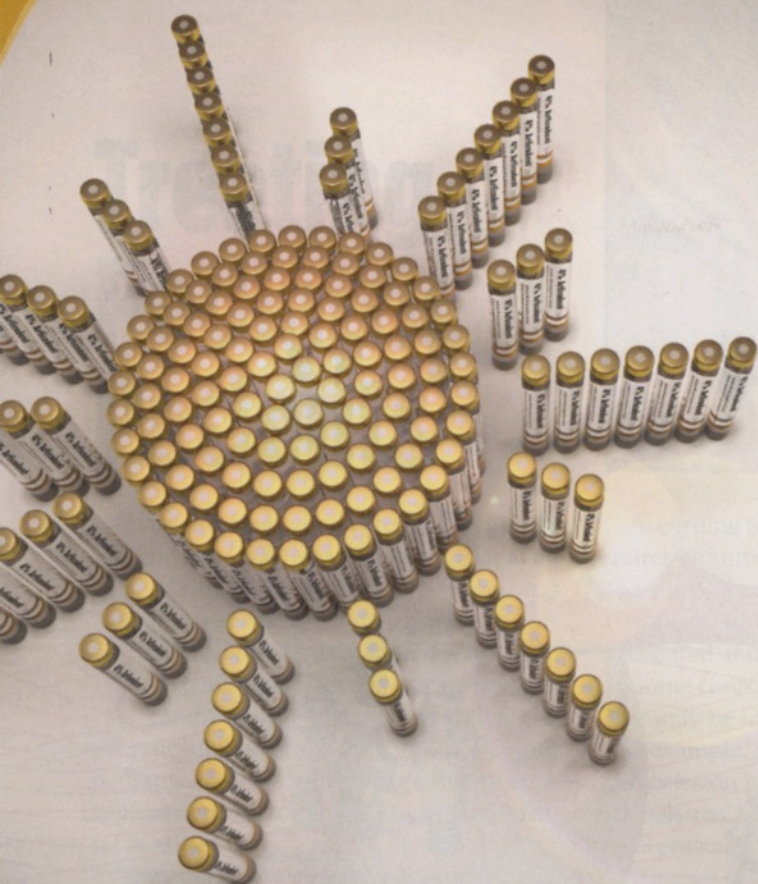
And manufacturers do offer a wide variety of dental diamonds and carbides to ensure that dentists are comfortable with what they're using for every application, including minimally invasive dentistry.

"Regarding minimally invasive preparations, our standard operative carbides are available in head sizes as small as .03 mm," notes Miranda Marchant, marketing manager for rotary instruments for Brasseler USA. "A specialty diamond line includes burs with head sizes as small as .07 mm, which are ideal for minimally invasive preparations."

However, one of the practical challenges of restoring minimally prepared teeth is adapting the restorative material into the preparation, Lawson points out. Flowable composites are easier to adapt, and the current generation of flowable composites are more highly filled, have better properties than they did in the 1990s and 2000s, and recent clinical studies have shown that flowable composites perform well in load-bearing restorations.

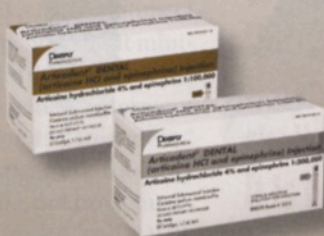
"I believe most dentists would tell you that more aggressive porcelain restorations (ie, crowns, traditional porcelain veneers) are longer-lasting than more conservative composite restorations (ie, composite bonding). The incorrect assumption that composite is a second-rate material compared to porcelain leads to a mistaken preference for porcelain restorations by most dentists," observes Willhite. "Not in all cases, certainly, but in many—if not most—the benefits of using composite greatly outweigh those of porcelain. And this includes complex cases—even bruxers who aren't compliant with using a nighttime appliance."

Yet, because the materials used in minimally invasive dentistry do make a difference—and some are not effective or as effective without significant tooth preparation—it's always wise to consult with colleagues and ask their opinion on why they choose certain materials. Then, with each case, consider the size of the lesion, the age of the patient; any medical conditions the patient may have (eg, GERD, diabetes, etc.), the location of lesion, whether



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the lesion is in a load-bearing and/or esthetic zone, and whether bio-activity is a requirement. Then, a material can be chosen that has the physical properties, clinical characteristics, and chemistry to satisfy those requirements.

Finding the Balance

To achieve predictable results in their minimally invasive and conservative efforts, dentists must spend time researching and educating themselves about adhesive technology, as well as current minimal-preparation and porcelain-bonding techniques, which aren't things they typically learn in dental school, Weston cautions.

According to Sesemann, the adhesive protocol clinicians adopt must be committed to producing the best hybrid layer and seal they can create. Knowledge of dental materials is collaterally crucial, and knowing how to best prepare the dentition and the chosen material for an optimal bond is critical.

Although it's easy to be seduced by the convenience of online opportunities, verifiable learning occurs with face-to-face continuing education, Sesemann says. Questions can be answered, discussions can take place, and thoughts can be shared while everyone is engaged.

"The AACD is dedicated to providing as many educational opportunities as possible for clinicians to learn about minimally invasive dentistry, with options including the annual scientific session, focused courses held around the country, and the *Journal of Cosmetic Dentistry*," says Willhite. "The proliferation of hands-on courses at many meetings and study clubs offers at least a few opportunities for every dentist and laboratory technician to learn more. The Academy of Biomimetic Dentistry is another proactive group promoting minimally invasive techniques."

And when in the trenches, it doesn't hurt to reach out to mentors, colleagues, and trusted experts. "Emailing a question to a teacher or a company may not always result in a response, but it never hurts to try," notes Willhite. "A thoughtfully written question is very likely to get an answer, and including good photographs can help if the question concerns a particular problem or type of case. If an answer doesn't arrive in a week or two, send the question again, since emails are sometimes lost."

Conclusion

Now, more than ever, dentists have greater opportunities to translate the principles of minimally invasive dentistry into a "medical model" approach to managing caries, rather than undertaking surgical intervention to repair the results of caries. Although conservative restorative techniques can correct the effects of caries and other oral diseases, they do not cure or resolve them.

Therefore, to successfully incorporate minimally invasive principles into practice, dentists must balance unique patient and case requirements with material capabilities and conservative techniques based on ongoing, educated knowledge of today's available options.

"Materials or instruments per se do not make dentistry minimally invasive," notes Calliott. "Rather, it is a combination of a choice of treatment philosophy, materials, and technique that make the distinction between one versus the other."