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*Knowledge for Clinical Practice*



## Leveraging Advances in Restorative Dentistry

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Capabilities with  
Modern Materials  
& Technology*

*By Scott Coleman, DDS, MAGD*

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## ABSTRACT

Dentistry is an ever-evolving field. As technology improves, we are able to take these advances and apply them to clinical practice. Notable developments in the field of radiography have drastically improved practitioners' ability not only to diagnose caries and pathologies more effectively, but also earlier than ever before. Diagnoses with more detail, as well as more precise location of these potential problems, are also possible with modern-day radiographs. Technological advancements in dentistry are not limited to improved diagnoses. Caries removal and tooth preparation instruments, bonding systems, and restorative materials have improved over the years and provide practitioners with a wide array of choices in treatment. Some of the purported benefits of these advancements are improved chair time management, less pain reported by patients, and more retentive restorations. It is up to the individual practitioner to stay current on the new technologies available in the field, as well as their benefits and drawbacks. This article provides some examples of advancements in the field of restorative dentistry.

## ABOUT THE AUTHOR



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Dr. Coleman graduated cum laude from Stephen F. Austin State University in 1980 with a major in biology and a minor in chemistry. He earned his Doctor of Dental Surgery degree in 1984, graduating first in his class from

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## EDUCATIONAL OBJECTIVES

The overall goal of this article is to provide the reader with information on contemporary practices in general dentistry. After reading this article, the reader will be able to:

1. Describe modern-day detection methods including current radiographic techniques and the use of transillumination.
2. Review modern techniques to remove diseased tooth structure and procedures for restoration preparation.
3. Describe the benefits and drawbacks of different adhesive techniques as well as the main reasons for postoperative sensitivity.
4. Compare various composite systems available for tooth restoration.

## Introduction

Tooth enamel is the only human tissue that cannot repair or regenerate itself, while dentin and cementum have a limited capacity to do so.<sup>1</sup> Since the human dentition does not regenerate or substantially repair itself, our profession has a lot of work to do. With an increase in longevity and a radical change in western diets over the last century, the need for dental services to restore, and in some cases resurrect, the human dentition has never been greater.

Over the decades, an abundance of dental advances, in both materials and procedures, has allowed dentists to dramatically expand their capabilities to help patients keep and improve their teeth. Better nutrition helps them physiologically, and creating a smile that they desire helps the psychological aspect of their lives. This improvement is not only applicable to the adult patient population. A study by

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Bahsa et al. found that obvious gross dental malocclusions can significantly influence the psychosocial health of adolescents, leading some of them to evade partaking in social activities and even negatively impacting their academic success.<sup>2</sup> Improvement in the appearance of dentition can help with these issues. Thus, both the needs-base of a functioning dentition and the desire-base of an improved smile has placed our profession in an enviable position.

Recent advances in technology have opened up a whole new way of practicing dentistry. Today, we have a deeper understanding of the oral environment and the disease processes that can occur. Our ability to detect and diagnose dental disease has never been as comprehensive as it is today. We can find problems at a much earlier state and apply corrective measures in a conservative manner, saving the patient both time and money in maintaining their oral health.

Technology can drive practice growth. In today's social media world, everything gets shared – both good and bad experiences. It is much easier for patients to compare practices today without ever having to physically go into one. Positive technological experiences by your patients in your office will be discussed favorably within that patient's sphere of influence.

We will spend some time walking through some of the current technologies available in placing a typical direct restoration, following the clinical flow from detection to removal of diseased tooth structure to restoring the tooth. Simple tooth restoration comprises the majority of what a general dentist does on a day-to-day basis. Incorporating different technologies that improve time management and the final outcome can make a big impact on how we practice.

The three main reasons dentists adopt technology into their daily practices are:

1. Increased efficiency allowing more procedures to be done in the same allotted time. Most patients do not like sitting in a dentist's chair any longer than they have to, so the more efficient the process is, the better for both doctor and patient.
2. Increased breadth, new procedures, increased acceptance. Expanding the general dentist's capabilities allows the dentist to offer a broader range of services to their patients. If the general dentist can perform the required procedures, most patients would prefer that their dentist treat them. Having to go to a specialist that they are unfamiliar with is not something that patients look forward to and can create unnecessary anxiety. They would much prefer someone that they already know and trust take care of their needs.
3. Increased opportunity, more new patients, better retention. Updated technology in a dental office gives patients a better impression of the practice and the dentist's skills. The average

## 3 REASONS WHY DENTISTS ADOPT TECHNOLOGY

- **Increased Efficiency**  
More procedures in the same time
- **Increased Breadth**  
New procedures; increased acceptance
- **Increased Opportunity**  
More new patients: better retention



**Technology Drives Practice Growth**

patient has no way of determining the details of the particular dental procedure being performed on them, so they judge the competence of a practitioner by what their senses tell them: How does the environment look, smell, taste, sound, and feel? An updated office that looks clean and smells nice will go a long way in creating a level of trust for the patient by creating a sense of relaxation.



## Technology to Aid in Detection

Dentists are trained to perform a clinical examination using simple instruments: a mirror and an explorer. We look at the tooth and feel the tooth structure to determine its clinical health. With the addition of 2D radiography, we can have a better understanding of the condition of the tooth. According to the latest American Dental Association survey, more than 90% of dental practices in the United States today have digital radiography that will produce a digital two-dimensional radiograph. The move from film-based radiography to digital radiography has been well received and accepted by the profession. Advantages of digital over traditional (analog) models include secure storage and transfer of records; instantaneous availability of the image files; absence of labor-intensive chemical processing; and the ability to enhance the diagnostic characteristics of the image. Another proposed advantage of digital radiography is lower exposure dose. This can occur because digital images are not as likely to display the higher incidence of exposure and artifacts seen with conventional films.<sup>3</sup> The actual extent of exposure reduction is a topic of debate. Although some manufacturers claim a dose reduction of up to 90% compared to that of conventional films, van der Stelt claims the actual reduction is between 0-50%.<sup>4</sup>

The addition of 3D radiography in recent years has opened up a whole new world for practicing dentists. Cone beam computed tomography (CBCT) now allows us to view the dentition completely. CBCT is well suited for the imaging of bony structures of the maxillofacial areas and constructs 3D images in three planes (axial, sagittal, and coronal).<sup>5</sup> This imaging can provide the clinician with more detailed information not readily available via conventional or panoramic radiographs such as precise 3D location of pathology or impacted teeth, detailed information regarding root resorption, and even integrity of bone. The detail of a CBCT radiograph can even help the clinician identify problems earlier. While the increase in information is substantial, we always want to follow the ALADA (“as low as diagnostically acceptable”) principle for all ionizing radiation. CBCT units today impart doses of approximately the same as

2D digital units. All digital exposures for dental radiographs are far less than the medical-grade flat beam CT units. Dental CBCT scans produce far less detail than flat beam scans. All of the hard tissue (teeth and bones) is revealed with very little of the soft tissue (gingiva and mucosa.)

Several other adjuncts we use in detection of dental disease utilizing non-ionizing sources of energy have made great strides. Transillumination is a technique that has been used in dentistry for more than 50 years. Certain patients have a strong aversion to ionizing radiation, inhibiting our ability to detect interproximal and occlusal decay. Some of the different technologies today allow a non-ionizing energy source to help illuminate the teeth in a diagnostic manner. These techniques allow evaluation for tooth structure supragingivally, therefore limiting our ability to diagnose any root-related problems. Depending upon the wavelength of the energy source, the resulting images reveal different information. A magnified intraoral digital picture has a lot of useful information that can help with diagnoses. Fluorescence can be useful in determining enamel density and the presence of possible decay. Fluorescent technology uses the fact that the natural fluorescence of tissue is altered when diseased to distinguish between compromised tissue with that of its healthy counterpart.<sup>6</sup> Near-infrared light that is emitted at the gingival margin and captured or read at the occlusal surface has shown to be very helpful with occlusal, interproximal, and recurrent decay. At the applied wavelength, enamel starts to absorb fewer photons, so lesions appear as dark areas on a monitor. The visualization can be helpful not only for clinicians to identify and diagnose problematic areas, but it also allows patients to see all aspects of the tooth, potentially assisting in case acceptance. Despite their potential benefits in diagnostics, a study by Amaechi and Owosho recommends that fluorescence and NIR systems be used only as “adjuncts to clinical decision making” due to their current drawbacks. For example, fluorescence systems cannot specify the depth of carious lesions, while NIR systems cannot detect caries beneath restorations.<sup>6</sup>

Transillumination in many cases will show how

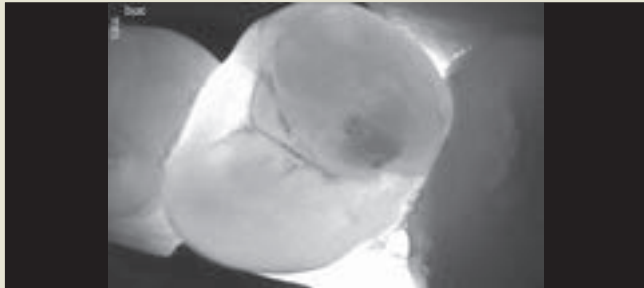


Figure 1. Tooth #13: occlusal caries has expanded widely at the CEJ.

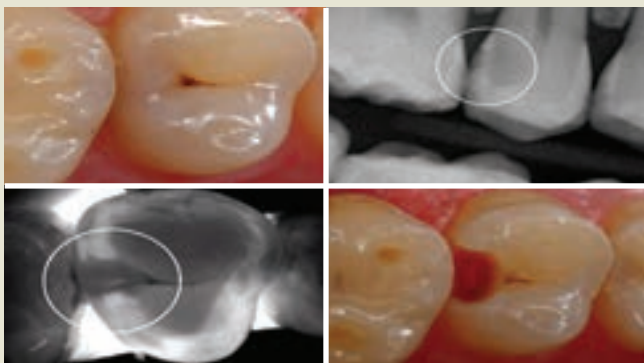


Figure 2. Comparison of intraoral image with a digital bitewing and transillumination view of distal decay

expansive the decayed area is on occlusal areas that may only have a minimal pit that would not allow a probe to be used (Figure 1). Combining transillumination with 2D digital imaging will provide both a vertical plane (digital radiograph) and a horizontal plane (transillumination) of areas above the gingival margin (Figure 2). It does not replace 3D CBCT but it gives a much better definition of coronal problems with the tooth — for a fraction of the price. The dentist can sometimes pick up interproximal decay with a radiograph, which can help in determining the occlusal-gingival position of the lesion. Adding the transillumination information allows you to add the buccal-lingual as well as the occlusal position of the decay. In current conservative prep designs, removing a minimal amount of healthy tooth structure is critical. Transillumination has been shown to detect decay much

earlier than an ionizing radiograph. You need approximately 30% density loss to be detectable on a radiograph.

Transillumination needs only a 10% loss in density to be detectable. So that we can find areas of decay much earlier, a determination can then be made either to monitor for follow-up or proceed with treatment.

### Tools to Aid in Removal of Diseased Tooth Structure

Once we have determined that a portion of a tooth needs to be restored, we proceed with the removal of the diseased or broken portion of the tooth, and prepare the remaining healthy part of the tooth for a restorative material. Typically for direct restorations, a form of composite material will be used. Traditionally tooth preparation has been accomplished utilizing a rotary handpiece with hand instruments. Pneumatic-driven rotary handpieces are most popular in the United States, primarily because of their light weight and lower initial investment. Electric-driven handpieces are heavier and cost more, but have the advantages of having higher torque, being quieter, and offering lower levels of vibration than their pneumatic counterparts.<sup>7</sup> Another benefit of electric handpieces are their efficiency in cutting through various materials often used in dentistry. Choi et al. found that electric handpieces were more efficient at cutting through silver amalgam, high noble alloy, and machinable glass ceramic when compared to an air-turbine handpiece.<sup>8</sup> Migrating from pneumatic to electric requires a slight learning curve, but once they've adapted, the majority of practitioners prefer the electric instruments.

Laser technology has been utilized in the dental field for a couple of decades now. Initially they were relegated to soft-tissue procedures, having the same functionality as electro-surge units — removing and reshaping primarily soft tissue. Hard-tissue lasers have advanced to allow clinicians to remove (ablate) enamel, dentin, and bone. Hard-tissue — and the latest, all-tissue — lasers include erbium (Er, Cr: YSGG and Er, YA6) and more recently CO<sub>2</sub> 9300 NM models. The ablating (vaporization) action of lasers occurs via the evaporation of water within the tissue, achieved via chromophoric absorption of specific wavelengths of light. The principal chromophores in dental hard tissues are water and hydroxyapatite.



Figure 3. Removal of decay and recontouring of hyperplastic tissue without anesthesia or bleeding

All-tissue lasers, specifically the CO<sub>2</sub> lasers at 9300NM, typically do not require the use of local anesthetic for enamel and dentin ablation. The specific mechanism that creates a short-term anesthesia effect within the tooth that is being treated is not known; several reasons are speculated but not confirmed. The ability to restore the majority of direct restorations without the need for anesthesia is a transformative experience for both the patient and the doctor. The removal of tooth structure is comparable to a rotary handpiece. The laser takes about 25 percent longer to remove the tooth structure compared with a handpiece and bur. It might take two minutes of laser time compared with a minute and a half with a rotary. The additional prep time is more than offset with the lack of anesthesia administration and waiting for anesthesia onset. Most soft-tissue removal is bloodless, which allows for a greater expansion of restorative options (Figure 3). Comparing a classical subgingival Class V restoration with an all-tissue laser process can reduce a normal 35-minute time span down to about 10 minutes because both hard and soft tissue can be removed simultaneously. Without the need for anesthesia,

enhanced occlusal equalization can be accomplished with the added benefit of multi-quadrant procedures being accomplished in a single visit. This frees up chair time for patients and procedures. A systematic review by Tao et al. that compared erbium laser technology with traditional drilling for caries removal confirmed the increased time for cavity preparation and reduced local anesthesia requirement as fewer patients suffered from pain during caries removal using a laser. No significant difference, however, was found between the two methods regarding pulp vitality, postoperative sensitivity, and restoration loss.<sup>9</sup>

### Procedures for Preparation of Tooth Structure for Composite Restoration

Once the tooth preparation has been completed, the restoration of the tooth begins. Most restorative materials that are being used today require chemical adhesion to both enamel and dentin. The need for mechanical retention is greatly reduced or eliminated. In order to achieve great adhesion, isolation and control of the surrounding fluids must occur. Some of the methods used to accomplish this are utilizing a rubber dam or cotton rolls with saliva evacuation. Each case presents its own unique challenges. Isolation and control of pericrevicular fluids are essential. Packing retraction cord for control of subgingival margins has been a standard for decades, and is still widely used and accepted today. Other solutions for the fluid control issues are the use of lasers, primarily a soft-tissue diode, electrosurge, and retraction paste. In most cases, the use of a diode laser or the use of the electrosurge procedure will require anesthesia. Retraction cord sometimes can be placed without anesthesia depending upon the patient and the specific restorative case. Retraction paste usually does not need anesthesia. Several manufacturers make retraction paste, but most pastes are similar in composition: they are a clay combined with aluminum chloride, and are available in both low and high viscosity depending upon the specific tissue requirement. Even combinations



of cord and paste will work well in specific situations. A systematic review by Huang et al. supports the notion that gingival retraction paste can more effectively assist in achieving a dry field, while being less injurious to the gingiva. The authors do go on to state, however, that cord was more effective in displacing gingival tissue. Thus, they recommend both practices depending on the situation and how much gingival displacement is needed.<sup>10</sup> Regardless of the methods used, control of the area is essential for proper adhesion to be applied.

## Current State of Adhesive Dentistry

Adhesive dentistry has been a veritable game-changer for our profession. Without the need for mechanical retention, which was required for every material prior to ability to bond, we can dramatically reduce the amount of healthy tooth-structure loss due to prep design. We can now remove the diseased part of the tooth very conservatively. This allows us to place smaller amounts of man-made restorative material. Typically the more natural tooth we can retain, the better. Using an adhesive system is the key to this success. It is probably one of the most confusing topics in dentistry today. There are well over a hundred different adhesives on the market, all with different specifications: etch and rinse, self-etch, selective etch, dry bond, wet bond, universals, generational numbering, the list goes on and on. The manufacturers have inundated us with choices, each with a varying degree of steps and results. The challenge comes when we are trying to bond something to two different substrates, enamel and dentin, simultaneously. Enamel is made up of more inorganic component than any other tissue, approximately 98% mostly consisting of hydroxyapatite, while dentin consists of 70% mineral hydroxyapatite, 20% organic material, and 10% water.<sup>11, 12</sup>

This presents a problem because despite the two very different surface morphologies, we want similar bond strengths and durabilities. We also want a simplified, foolproof way of applying the agent quickly. It is no

wonder that there are so many approaches to the problem, with such a wide variety of outcomes. The holy grail is trying to create a single, one-protocol, any-procedure, quick process that is reliable, bonds to dentin and enamel, and is a resin material (composite.) Manufacturers have long used generational nomenclature to segment the various stages that adhesive have gone through, i.e., Gen 1, Gen 4, Gen 7. Once they reached Generation 7, they discontinued using generational numbers and began using the term “universal.” A universal adhesive is a self-etching (no need to separately etch) one- or two-bottle system that can be used for just about anything. The majority of universals are not resin specific, so that they can be used with most composite materials. Despite claims that self-etch systems can lower postoperative sensitivity, a systematic review by Reis et al. did not find a correlation between adhesive strategy (self-etch vs etch and rinse) of posterior composite restorations and risk or intensity of postoperative sensitivity.<sup>13</sup>

It is crucial to understand the four main reasons for postop sensitivity in bonded restorations.

1. Over-etching dentin
2. Under-priming
3. Inadequate drying
4. Under-curing

## Postoperative Sensitivity Etch & Rinse

1. Over-etching dentin
2. Under-priming
3. Inadequate drying
4. Under-curing



If you can eliminate those four areas of concern, you should not have postop sensitivity due to bonding failure. By using a self-etching universal adhesive, the first two problems of over-etching and under-priming should be resolved. The third area, inadequate drying, is simple to fix: All of the adhesives contain one or more solvents, typically acetone, ethanol, and water. They are used to help deliver the adhesives to the desired surfaces. Once they are placed and scrubbed in to mechanically force the adhesive into the dentinal tubules, the solvents need to be removed by evaporation. Applying a dry airstream until there is no movement in the adhesive will evaporate all of the solvents in the formula.

In order to get maximum dentinal penetration into the collagen fibers and the dentinal tubules, it is necessary to have a moist dentinal environment. If the dentin is desiccated prior to applying the adhesive, desired penetration will not occur. Enamel needs to be dry, frosted appearing, and dentin needs to be moist, wet in appearance, before applying the resin. Once the adhesive is applied and dried, then cure the surface for 10 seconds. If the dentin is not shiny, place a second layer of adhesive. Multiple layers (with today's adhesives) improve the bond strengths, so don't be afraid of applying too much adhesive as long as you are drying and curing between applications. Do not place the composite until a shiny dentin surface is achieved.

The last concern is under-curing. Most systems today require a minimum of 40 seconds of curing with a high intensity curing light of greater than 1000 mW/CM<sup>2</sup>. Studies have shown that over 40 percent of dental practices use inferior lights. Under-curing the resin and the composite can be a real problem, so check the intensity of the curing light regularly with a photometer to inspect the intensity. Buying inferior curing lights because of the smaller initial expense will eventually cost more in time and effort to deal with the associated sensitivity.

## New Composite Systems to Aid in Restoration

As composite restoration systems have changed, there has also been an evolution of the materials from initial self-

curing mixable composites to multiple layers of light-cured composites to differing viscosity composites to combining different types of composites. Each version was designed to correct some of the inadequacies of the materials. Varying filler particle sizes have played a dominant role in the physical properties of composite makeup. More posterior composites than anterior composites are placed in today's dental practices due to the different functionality of anterior and posterior teeth.

Posterior composite restorations need to be aesthetic, seal the tooth, reinforce the tooth, and require the most conservative tooth preparation. The biggest challenges for posterior restorations are predictable contacts, postoperative sensitivity, and placement time and effort. Problems with predictable contacts have been virtually resolved with segmented matrix systems. These allow specific matrix shapes to be applied in a precise manner. Postoperative sensitivity is either an adhesion issue, which has already been addressed, or an occlusion problem. Anesthetized teeth can be difficult to correctly address the occlusion, simply because neither the patient nor the doctor can be sure if they are biting in a normal pattern without the ability to sense contact points. Anesthesia-free restorations eliminate this problem. Placement of the composite takes time and effort. Placing a flowable with overlaying multiple layers of restoration composite to achieve the desired result is one of the least productive per-hour services that a dentist offers. Improving the placement of the posterior composites will help the economics of the procedure dramatically.

The advent of bulk-fill materials, both flowable and layering composites, has been an attempt to correct the time value proposition of posterior composites. A literature review by Sabbagh et al. states that bulk-fill composites award the clinician with decreased application time mainly due to increased depth of cure.<sup>14</sup> There are several schemes to bulk-fill placement. The two biggest variables that need to be addressed in a bulk-fill system are adaption and strength. Flowables, or low viscosity composites, are great at adaption; their inherent low contact angle allows for an increase in wettability that affords great adaptation. The price for





## WHAT DENTISTS WANT: *Rapid, Single Increment, Bulk-Fill Replacement*

Dentin & Enamel Replacement



1 Layer

### Requirements:

1. High depth of cure
2. Less shrinkage
3. Increased mechanical properties
4. Adaptation
5. Esthetics

that adaptation is strength, which is much lower in flowables compared with the high viscosity of restorative type of composites. The high viscosity (restorative) composites have a high contact angle and decreased wettability, which results in poor adaptation. Different schemes have been developed in an attempt to gain the advantages of both. These still require at least two layers: a flowable and a layer covered by a restorative layer in varying amounts. The true requirements of an ideal posterior composite would be: fast, single increments, bulk-fill placement with a high depth of cure, low shrinkage stress, high mechanical properties, great adaptation, and perfect esthetics.

One novel approach to solving this puzzle is the use of sonic energy on restorative composites. Utilizing sonic energy to transform a high-viscosity restorative composite to a low-viscosity flowable solves the adaptation problem. Removing the sonic energy from the material allows it to return to its high-viscosity restorative nature, which can be pressed and sculpted as usual. So in less than 5 seconds, a filling of 5 mm in depth (a majority of cavities are less than 5 mm) can be filled with perfect adaptation. The composite can be sculpted and cured, and a normal 40-second cure will complete the restoration. In a study comparing the flexural and compressive strengths of a sonic-activated bulk-fill system with a universal posterior composite resin as

well as other bulk-fill resins, Didem et al. found that the sonic-activated composite had higher compressive and flexural strength than the other groups.<sup>15</sup> This sonic-activated placement procedure was developed in 2007 and has many years of clinical trials to validate its performance and longevity.

### Quick and Simple Finishing and Polishing

Once the composite is cured, the isolation technique can be removed. Removal of any remaining flash resin can be removed with a scalpel, flexible disk, or finishing carbide bur. In order to decrease the armamentarium needed for each procedure, try to streamline the list of things needed to complete each case. One preference is to use a carbide finishing bur, both flame and football shape for resin flash removal and contouring of the composite. Once the contours have been adjusted, the occlusion is relieved and polishing begins. Several composite polishing systems are widely used in the United States today. Some have multiple color-coded grits that are used sequentially to obtain a luster that mimics natural tooth structure. Due to the advancement of composite molecular makeup, most new composite formulations are much easier to polish. In accordance with the material advancements, polishing systems have advanced as well. Typically a single-point, disk- or cup- shaped polishing agent is all that is needed to obtain a beautiful luster on the composite material.

### Concluding Remarks

Dental technology and materials continue to evolve, improve, and in some cases, revolutionize the clinical options available for the delivery of patient care. In the hands of a trained, caring professional, technology such as transillumination, CBCT, digital imaging, all-tissue lasers, adhesive systems, next-generation composites, and simplified single-step polishing can pay dividends not only in practice efficiency and growth, but — most importantly — improve clinical outcomes as well as optimal patient care and experience. Practitioners should always consider how they would want their teeth restored, and provide exactly that.



## CLINICAL CASES

### Case 1

This patient presented with a failing D.O. amalgam restoration on tooth #20. After isolation and removal of the existing amalgam, the prep was thoroughly washed with water. A selective etch of 10 percent phosphoric acid was placed on the exposed enamel surfaces not exceeding the DEJ. Although not required by the manufacturer, selective surface etching will routinely increase the bond strength on enamel by 10-20%. Following this, a coat of universal bond was added, air-dried to remove any solvent, and then cured for 10 seconds. A shiny dentin surface was confirmed before continuing (Figure 1). Using a sonically activated composite, the tip was placed

in the bottom of the distal box. At this point, the rheostat was depressed, filling the box and the occlusal surface mesially. Once filled, the rheostat was released and the composite tip removed. The tip used is much smaller than a standard composite carpule and can get into much smaller areas of a prep (Figure 2). The occlusal surface of the restoration was sculpted and cured from the occlusal for 10 seconds using a curing light (Figure 3). The restoration was then contoured and occlusally adjusted using a carbide football bur and polished with a polishing disk and point (Figure 4). Figure 5 shows a “before” treatment photo as well as a five-year follow-up photo for comparison. Notice the low luster after five years. The current composite has addressed that problem and has improved the sculpting characteristics as well.

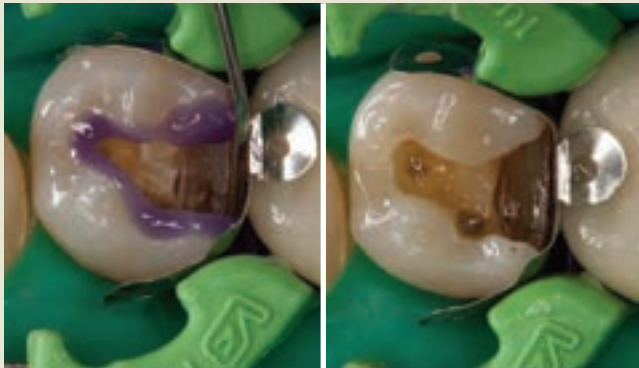


Figure 1. Selective etching of enamel. Finished tooth preparation after etch/bond prior to fill



Figure 3. Sculpting of composite and subsequent curing



Figure 2. Filling prepared tooth with sonically activated composite; comparison of different-sized composite carpule tips

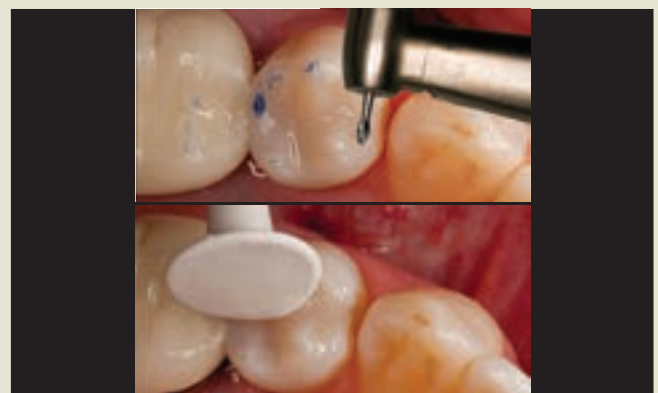


Figure 4. Contouring and polishing composite after light cure

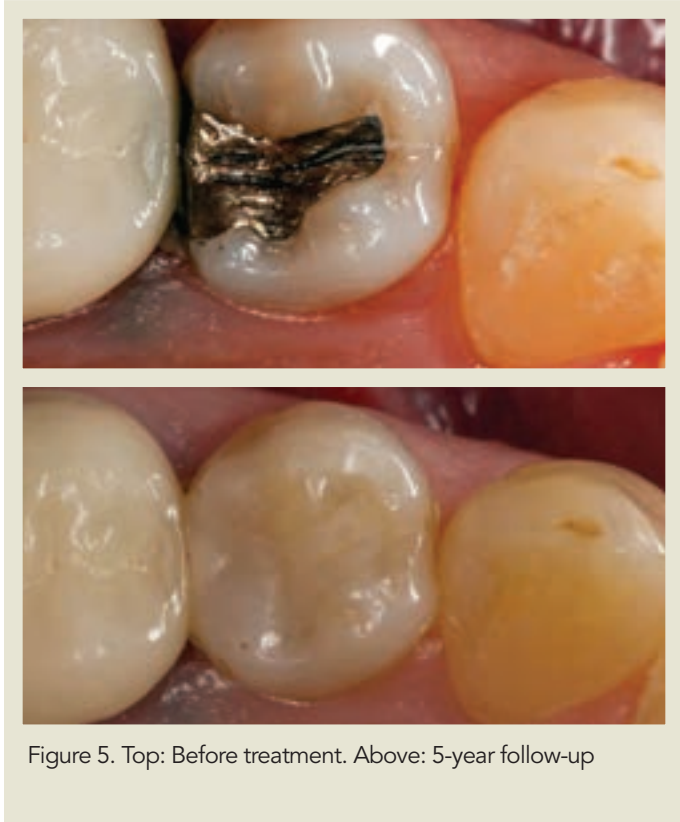


Figure 5. Top: Before treatment. Above: 5-year follow-up



Figure 8. Close-up of clinical presentation



Figure 9. Final restoration of tooth

### Case 2

An area of possible decay was found on the mesial of tooth #2 (maxillary right 2nd molar) using a transillumination system (Figures 7-8). A CO<sub>2</sub> all-tissue laser was used without anesthesia to remove the decay.



Figure 7. Possible decay as seen with transillumination system and its clinical presentation

A universal bond was placed and cured, followed by placement of a sonically activated composite, which was then cured. The restoration was contoured and polished (Figure 9). The total time for this restoration was under 7 minutes.



## Case 3

An elderly patient, suffering from initial onset of dementia, was seen with a broken maxillary left cuspid #11 (Figure 10). The tooth had an existing composite restoration with recurrent decay. Due to the extensive damage, a full coverage ceramic crown was recommended. The patient's caregiver, however, wanted a less expensive and quicker solution. A bonded anterior composite was then suggested. Removing the decay and existing composite followed

by gingival recontouring were accomplished with a CO<sub>2</sub> laser without anesthesia and within a five-minute time frame. A low-viscosity, hemostatic retraction paste was used for isolation to help secure optimal bonding (Figure 11). A universal bond was used for the restoration utilizing dentin shade A-3.5 with enamel shade A-3 as the final layer. The restoration was finished with carbide finishing burs and a disk and cup was used for the final luster. It shined like the grill on a low rider and the patient was thrilled.

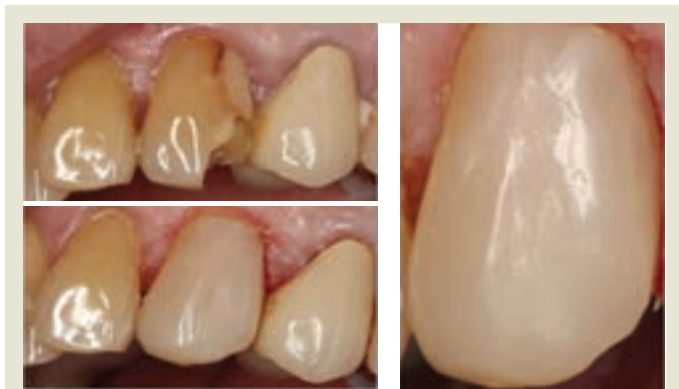


Figure 10. Upper left cuspid (#11) with broken restoration and recurrent caries. Cuspid after restoration with new bonded composite.

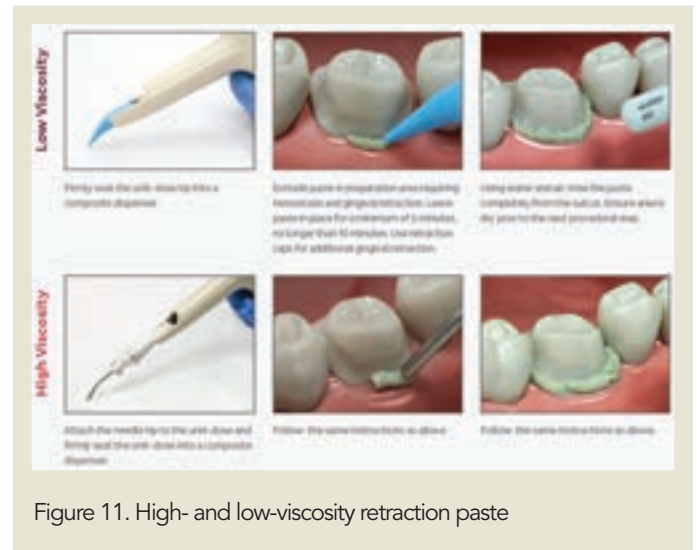


Figure 11. High- and low-viscosity retraction paste

## References

1. Huang George T.-J. Huang. Dental pulp and dentin tissue engineering and regeneration-advancement and challenge. *Front Biosci (Elite Ed.)*; 2011;3:788-800.
2. Basha S, Mohamed RN, Swamy HS, Parameshwarappa P. Untreated gross dental malocclusion in adolescents: psychological impact and effect on academic performance in school. *Oral Hlth Prev Dent*. 2016;14(1):63-69.
3. Pontual AA, de Melo, DP, de Almeida SM, Boscolo FN, Neto FH. Comparison of digital systems and conventional dental film for the detection of approximal enamel caries. *Dentomaxillofac Rad*. 2010;39(7):431-436.
4. Van der Stelt Paul F. Better imaging: The advantages of digital radiography. *J Am Dent Assoc*. 2008;139:Supplement 3:S7-S13.
5. Scarfe WC, Farman AG. What is cone-beam CT and how does it work? *Dent Clin N Am*. 2008;52(4):707-730.
6. Amaechi BT, Owosho AA. Fluorescence and near-infrared light transillumination. *Dent Clin N Am*. 2018;62(3):435-452.
7. Christensen G. Are electric handpieces an improvement? *J Am Dent Assoc*. 2002;133(10):1433-1434.
8. Choi C, Driscoll CF, Romberg E. Comparison of cutting efficiencies between electric and air-turbine dental handpieces. *J Prosthet Dent*. 2010;103(2):101-7.
9. Tao S, Li L, Yuan H, Tao S, Cheng Y, He L, Li J. Erbium laser technology vs traditional drilling for caries removal: A systematic review with meta-analysis. *J Evid Based Dent Pract*. 2017;17(4):324-334.
10. Huang C, Somar M, Li K, Mohadeb JVN. Efficiency of cordless versus cord techniques of gingival retraction: A systematic review. *J Prosthodont*. 2017;26(3):177-185.
11. Curson MEJ, Duggal MS. Dental disease. *Encyclopedia of Food Sciences and Nutrition*. 2nd ed. 2003:1743-1746.
12. Chun KJ, Choi HH, Lee JY. Comparison of mechanical property and role between enamel and dentin in the human teeth. *J Dent Biomech*. 2014;5.
13. Ries A, Loguericio AD, Schroeder M, Luque-Martinez I, Masterson D, Maia LC. Does the adhesive strategy influence the post-operative sensitivity in adult patients with posterior resin composite restorations? A systematic review and meta-analysis. *Dent Mater*. 2015;31(9):1052-1067.
14. Sabbagh J, McConnell RJ, McConnell MC. Posterior composites: Update on cavities and filling techniques. *J Dent*. 2017;57:86-90.
15. Didem A, Gozde Y, Nurhan O. Comparative mechanical properties of bulk-fill resins. *OJCM*. 2014;4(2):117-121.

## CEQuiz

To complete this quiz online and immediately download your CE verification document, visit [www.dentallearning.net/ard-ce](http://www.dentallearning.net/ard-ce), then log in to your account (or register to create an account). Upon completion and passing of the exam, you can immediately download your CE verification document. We accept Visa, Mastercard, Discover, and American Express.

- Which of the following is completely incapable of regeneration?
  - Enamel
  - Cementum
  - Dentin
  - All of the above
- A study by Basha et al. found that obvious gross dental malocclusions can significantly influence the psychosocial health of adolescents and even lead some of them to:
  - Misbehave in class
  - Evade partaking in social activities
  - Skip class
  - All of the above
- According to a survey by the American Dental Association, approximately what percentage of dental practices in the United States has digital radiography?
  - More than 60%
  - More than 70%
  - More than 80%
  - More than 90%
- Some of the advantages of digital radiography over traditional radiography include:
  - Secure storage
  - Instantaneous availability of images
  - Absence of chemical processing
  - All of the above
- A review by van der Stelt claims that the exposure reduction in digital radiography is approximately how much lower when compared to traditional radiographs
  - 0-25%
  - 0-40%
  - 0-50%
  - 0-75%
- CBCT constructs images in 3D and provides information in which plane?
  - Axial
  - Sagittal
  - Coronal
  - All of the above
- CBCT can provide detailed information on which of the following?
  - Location of pathology
  - Location of impacted tooth
  - Root resorption
  - All of the above
- Dental CBCT scans provide far less exposure than medical-grade flat beam CT units
  - True
  - False
- Fluorescence technology uses the fact that the natural fluorescence of tissue is altered when diseased to distinguish between compromised tissue with that of its healthy counterpart.
  - True
  - False
- Near-infrared light transillumination can detect caries beneath restorations.
  - True
  - False
- Radiographs require approximately what percentage of density loss to detect caries?
  - 10%
  - 20%
  - 30%
  - 40%
- Transillumination requires what percentage of density loss to detect caries?
  - 10%
  - 20%
  - 30%
  - 40%
- Disadvantages of electric-driven handpieces include which of the following?
  - Heavier
  - Louder
  - Higher level of vibration
  - Lower torque
- Advantages of electric-driven handpieces include which of the following?
  - Louder
  - Higher torque
  - Lower torque
  - Cheaper
- A study by Choi et al. found that electric handpieces, when compared to air turbine handpieces, were more efficient at cutting through which of the following?
  - Silver amalgam
  - High noble alloy
  - Machinable glass
  - All of the above



## CE QUIZ

16. When compared to traditional handpiece and bur, lasers take approximately how much longer to remove tooth structure?
- 15%
  - 25%
  - 35%
  - 45%
17. A systematic review by Tao et al. that compared lasers to traditional drills in regard to caries removal confirmed which of the following?
- Reduced local anesthesia requirement
  - Reduced pulp vitality
  - Reduced postoperative sensitivity
  - All of the above
18. Methods for isolation and control of pericrevicular fluids include which of the following?
- Retraction cord
  - Retraction paste
  - Electrosurge
  - All of the above
19. Most retraction pastes on the market are composed of clay combined with which of the following?
- Sodium chloride
  - Potassium chloride
  - Aluminium chloride
  - All of the above
20. Enamel is composed of approximately what percentage of hydroxyapatite?
- 68%
  - 78%
  - 88%
  - 98%
21. Dentin is composed of approximately what percentage of water?
- 10%
  - 20%
  - 30%
  - 40%
22. Which of the following is a main cause for post operative sensitivity?
- Over-etching the dentin
  - Under-priming
  - Inadequate drying
  - Under-curing
  - All of the above
23. A systematic review by Reis et al. found a correlation between adhesive strategy (self-etch vs etch/rinse) of posterior composite restorations and risk or intensity of postoperative sensitivity.
- True
  - False
24. In order to get maximal dentinal penetration into collagen fibers and dentinal tubules, the dentinal environment must be which of the following?
- Moist
  - Dry
  - Dentinal environment doesn't matter
  - None of the above
25. Most systems today, when using a high-intensity curing light greater than 1000 mW/CM<sup>2</sup>, require a minimum of how many seconds of curing?
- 20
  - 30
  - 40
  - 50
26. Approximately what percentage of dental practices uses inferior curing lights?
- 30%
  - 40%
  - 50%
  - 60%
27. Some challenges of posterior composites include which of the following?
- Predictable contacts
  - Postoperative sensitivity
  - Placement time
  - All of the above
28. According to Sabbagh et al., the main reason for the decreased application time for bulk-fill composites is which of the following?
- Viscosity
  - Wettability
  - Depth of cure
  - All of the above
29. Didem et al. found that a sonic-activated bulk-fill system had higher compressive and flexural strength than a universal posterior composite resin and other bulk-fill resins.
- True
  - False
30. Removal of flash composite can be accomplished by which of the following?
- Scalpel
  - Flexible disk
  - Finishing carbide
  - All of the above

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### EDUCATIONAL OBJECTIVES

- Describe modern-day detection methods including current radiographic techniques and the use of transillumination.
- Review modern techniques to remove diseased tooth structure and procedures for restoration preparation.
- Describe the benefits and drawbacks of different adhesive techniques as well as the main reasons for postoperative sensitivity.
- Compare various composite systems available for tooth restoration.

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- Clarity of objectives ..... ③ ② ①
- Usefulness of content ..... ③ ② ①
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- Usefulness of the references ..... ③ ② ①
- Quality of written presentation ..... ③ ② ①
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|---------------------|---------------------|
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| 2. (A) (B) (C) (D)  | 17. (A) (B) (C) (D) |
| 3. (A) (B) (C) (D)  | 18. (A) (B) (C) (D) |
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| 5. (A) (B) (C) (D)  | 20. (A) (B) (C) (D) |
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| 7. (A) (B) (C) (D)  | 22. (A) (B) (C) (D) |
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| 10. (A) (B) (C) (D) | 25. (A) (B) (C) (D) |
| 11. (A) (B) (C) (D) | 26. (A) (B) (C) (D) |
| 12. (A) (B) (C) (D) | 27. (A) (B) (C) (D) |
| 13. (A) (B) (C) (D) | 28. (A) (B) (C) (D) |
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