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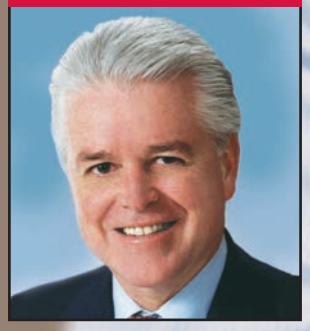

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Augmentation Versus Amputation

Implementing Noninvasive and Minimally Invasive Protocols for Maximum Success

Robert C. Margeas, DDS

INTRODUCTION

Minimally invasive dentistry is a buzz phrase that means different things to many clinicians. One dentist may think a three quarter porcelain veneer is conservative, where another believes it is too destructive of tooth structure. During the last several years, technological developments have allowed clinicians to be more respectful of tooth structure. G. V. Black's classification of cavity preparation was based on the restorative needs of the materials used at a particular time in our dental history. It was necessary to create resistance and retention form so the restoration would not fall out. This required removing more tooth structure to produce converging walls and to create retention grooves.[1,2] When Black proposed his preparation principles and his classification system of cavity design, dentists were more focused on controlling caries and not on the scientific knowledge of the disease.[3,4] At the time, neither the fluoride ion nor the process of remineralization was known.[5] Today, research is geared toward materials that are bioactive or anticarious. An example would be a product like CariFree, developed by V. Kim Kutsch, DMD, who has dedicated his career to develop new ideas, technologies, and treatment methods to help eradicate caries.

The term *extension for prevention*, introduced by Black, referred to a preparation that was extended to the proximal line angles so the margins of the restoration would be self-cleansing by way of food excursion. It also included extending preparations through all the enamel fissures, whether carious or not, to allow cavosurface margins to be placed on nonfissured enamel.[6] This phrase could now be changed to *extension for destruction* since we no longer need to remove healthy tooth structure in order to retain our restoration. These concepts of the "Mechanical Era in Dentistry" sanctioned the removal of healthy tooth structure with the sole purpose of retaining the restorative material.[7]

Composite Versus Amalgam Preparations

The requirement of a composite resin preparation versus an amalgam is different. With the ability to bond to tooth structure, we are able to be much more conservative with our preparation design. The problem remains that several of the restorative concepts and principles of the past are still being performed with the current adhesive technique. The effect of this misdirection could be one of the reasons for the relatively short longevity of adhesive restorations in the general dental practice.[8,9] Advances in material science and adhesive technology require the clinician to modify nonadhesive restorative techniques for application to restorative adhesive concepts when considering diagnosis, material selection, preparation design, restorative placement techniques, pulp protection, restorative finishing, and maintenance of the restoration.[10] There have been numerous new classification systems designed since the original principles of cavity classification were first viewed as outdated.

CASE 1

Figure 1. Pre-op smile.

Figure 2. Pre-op close-up.

Figure 3. Pre-op left lateral view.

Figure 4. Pre-op right lateral view.

PREVENTION

Today, dentists should have as their clinical objectives: prevention, preservation, and integrity in order to make the right decisions for their patients. The primary objective for the clinician is to prevent the placement of the initial restoration.[11] The most minimally invasive procedures include remineralization, sealants, and preventive resin restorations that require the least amount of tooth removal. The patient's diet, oral hygiene, fluoride use, and regular recare help reduce dental caries. This preventive approach provides the patient and clinician an opportunity to re-evaluate the outcome of the preventative measures and possibly reduce the potential for invasive intervention. Furthermore, this process involves educating the patient and involving him or her in the treatment decisions, which may result in acceptance of appropriate preventive and restorative strategies in caries management and improved patient compliance and oral health.[12]

When Restorative Work Is Necessary

With the ability to bond to tooth structure, adhesive preparation designs should be based upon the conservation of tooth structure and utilizing adhesive restorative materials.[13] The

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CASE 1

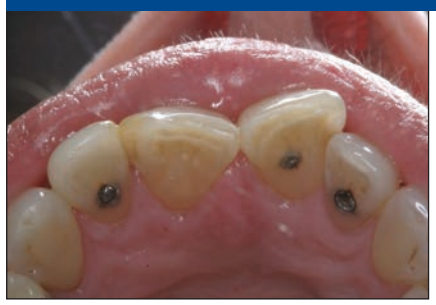

Figure 5. Pre-op occlusal view.

Figure 6. Etching gel (Ultra-Etch [Ultradent Products]) placed on left lateral incisor (No. 10).

Figure 7. Microfilled composite resin (Renamel [Cosmedent]) was then placed and sculpted.

Figure 8. Etch placed on left central incisor (No. 9).

Figure 9. Polished interproximal of left central.

Figure 10. Post-op restorations (teeth Nos. 7 to 10) prior to polish.

Figure 11. Post-op restorations after polish.

Figure 12. Post-op smile showing the completed aesthetic and noninvasive composite resin restorations on teeth Nos. 7 to 10.

Figure 13. Post-op right lateral view.

Figure 14. Post-op left lateral view.

Figure 15. Post-op occlusal view.

Augmentation Versus Amputation...

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conservative concept of the adhesive tooth preparation requires a biologic approach,[14] which represents a key component to adhesive dentistry.[15] The adhesive restoration does not require as much volume to resist clinical fracture, which enables a more conservative preparation design.[16] This conservative approach hopefully minimizes the restoration and replacement cycle for the patient throughout his or her lifetime. It has been demonstrated that smaller restorations can have an increased clinical performance and lifespan.[17]

Being able to bond to tooth structure has changed the playing field of dentistry. Adhesive dentistry has allowed more conservation of tooth as stated earlier, but materials are being improved with more physical, mechanical, and optical properties similar to tooth structure.[18] Restoring the natural dentition with bonded composite or porcelain reinforces the natural tooth and restorations almost as if nothing were done to the tooth if the preparations are conservative and bonded, as shown by Magne and Belser.[19]

The cavity preparation for a direct composite restoration is usually limited to the carious enamel and dentin. For porcelain, the preparations are not as conservative due to the removal of undercuts for proper path of insertion and adaption to the cavity walls. The direct composite can be used with minimal preparation because it uses the undercuts and surface irregularities to increase the surface area for bonding. This really conserves the dentin and reinforces the tooth to help reduce the chances of fracture during function or helps prevent a catastrophic failure of the tooth. I would rather replace a restoration than have the whole tooth fracture due to a rigid restoration.

When it comes to porcelain veneers, I feel it is one of the strongest restorations we have in dentistry, when done properly. Having more than 28 years of experience preparing and placing veneers, the most important thing in predicting long-term success is enamel preservation. When veneers are prepared minimally in enamel, they will not debond. They may chip, stain, or have recession, but in my clinical experience, they do not pop off. Even as conservative as porcelain veneers are, they are not a lifetime restoration. Calamia[20] first described the technique in 1983. Since veneers are usually an elective procedure, patients need to understand that they are not 100% successful. The patients are placing themselves on the cycle of restorative dentistry that needs to be replaced from time to time. No study shows that they are infallible.

The following 2 cases will serve as examples that demonstrate the minimally invasive philosophy that we employ in our practice on a daily basis. The procedures are conservative in nature, done in a responsible manner with long-term solutions in mind that are designed to keep any future treatments to a minimum.

CASE REPORTS

Case One

Diagnosis and Treatment Planning—A 59-year-old female presented to our office because she was not happy with her smile. She wanted a quick fix because she and her husband were going to be on the cover of a tae kwon do magazine in a few weeks, highlighting their business. I talked to the patient about orthodontic treatment and informed her that it would be the best treatment option. She was not interested in orthodontics and wanted to know what other options she might have. I explained to her that the only way I would treat her was if there were no preparation of the teeth, permitting her to have orthodontics in the future if she so desired. There would not even be any enameloplasty done. The only removal of tooth structure would be by acid-etching. This is truly an augmentation versus amputation case. There would be a small aesthetic compromise due to no preparation.

Her full smile is in Figure 1, and a close-up view is in Figure 2. From the lateral views (Figures 3 and 4), you can see the rotation of the central incisors and the poorly done diastema closure. The objective was to see if we could correct the rotation of her centrals and give her the appearance of a straight smile.

Clinical Protocol—An alginate impression was made of her upper teeth to see if a mock-up could accomplish what I wanted. The occlusal view is in Figure 5. To achieve the desired result without preparing the teeth, the distal of the left central would be the line angle to which I would build out my final contour. The patient would not have a problem with the material being too thick, as this was the area that was already touching her lip.

A microfilled composite resin (Renamel [Cosmedent]) would be my material of choice, due to its translu-

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Augmentation Versus Amputation...

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cency and polishability. I did not need strength in this area because we would have the natural tooth as the lingual backing. Due to the financial constraints the patient had, I only used one shade of composite to expedite the procedure. This was done in 2 hours of chair time. Matrix strips were placed to protect the adjacent teeth, and the left lateral incisor was etched with phosphoric acid (Ultra-Etch [Ultradent Products]) (Figure 6) for 20 seconds. This allows the material to be placed next to the adjacent tooth and not bond to it. A universal adhesive (Scotchbond Universal [3M ESPE]) was applied on the tooth and then light cured for 20 seconds. Next, the composite was placed in one increment onto the facial surface of the lateral and sculpted to shape (Figure 7). The matrix bands were used as instruments and pulled to the lingual to form a tight contact.

The next tooth was then etched (Figure 8) and adhesive and composite were placed, then sculpted to shape. The tooth was built out on the mesial to correct the rotation. It is very important to polish the interproximal of the restoration (Figure 9), because once done, the next restoration would be allowed to stick to the polished surface but would not adhere to it. An instrument was placed between the teeth and slightly twisted to torque the restorations apart (a technique first described by Dr. K. William "Buddy" Mopper). The polish was accomplished using discs (Flexi-Discs [Cosmedent]).

The right central and lateral incisors were then completed in the same manner (Figure 10). To polish the interproximal and provide a smooth surface, EPITEX Strips (GC America) were used. The final polish was achieved with enamelize and a FlexiBuff (Cosmedent) (Figure 11). The patient was happy with the final result (Figures 12 to 15), as was I. This case would not have been appropriate for preparation due to the amount of enamel that would have needed to be removed.

An innovative product out of Australia, Uveneer, has recently hit the market. It allows you to build a full composite veneer by utilizing a clear plastic form of a central, lateral, cuspid, or bicuspid built on a handle similar to a VITA shade tab. It comes in medium and large sizes, and the user can choose the size that best fits the tooth, then place composite on the tooth following acid-etching and adhesive placement. While the composite is soft, the form is placed on the tooth and excess material around the margins is removed. The composite is then light cured through the form and the former is removed. The tooth formers are autoclavable, so they can be used many times. This leaves a very high shine of composite, due to no air-inhibited layer being present. You then finish and polish the margins. This product is an aid for practitioners who don't have the time to layer or charge enough due to the time it takes to create an ideal restoration. There is a learning curve, and it is recommended to start with a single tooth prior to trying multiple teeth.

CASE 2

Figure 16. Pre-op of fractured teeth.

Figure 17. Fractured pieces.

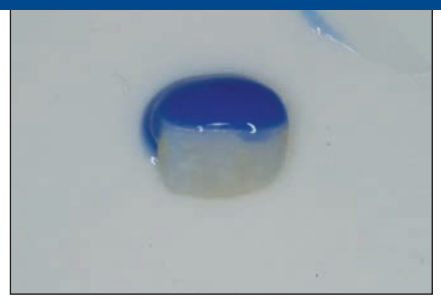

Figure 18. Etch placed on fragment (left central incisor).

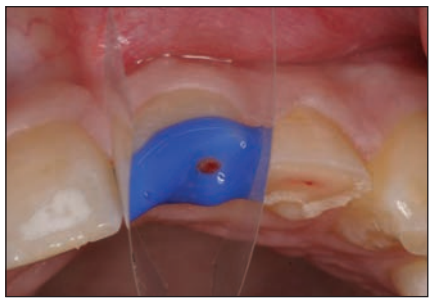

Figure 19. Etching gel placed on tooth No. 9.

Figure 20. A 4th generation adhesive (ALL-BOND 3 [BISCO Dental Products]) primer was placed on tooth.

Figure 21. ALL-BOND 3 adhesive placed on tooth.

Figure 22. Adhesive placed on fragment.

Figure 23. Insure resin cement placed on fragment.

Figure 24. Fragment placed.

Figure 25. Fragment bonded to place (No. 9).

Figure 26. Post-op smile after fragments teeth Nos. 9 and 10 were bonded to place.

Figure 27. Close-up of teeth following bonding of fragments.

Figure 28. Preparation of teeth for porcelain veneers in enamel.

Figure 29. Etch placed on No. 9.

Figure 30. Note the frosty appearance of the etched enamel.

Case 2

Diagnosis and Treatment Planning—A 17-year-old male presented with traumatically fractured left central and lateral incisors (teeth Nos. 9 and 10)

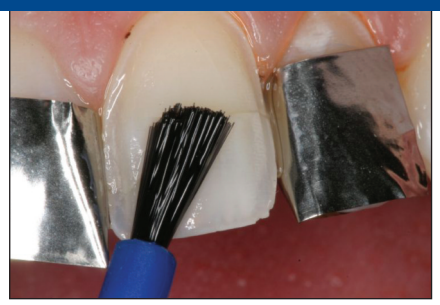

Figure 31. ALL-BOND 3 primer placed on tooth.

Figure 32. ALL-BOND 3 adhesive placed on tooth.

Figure 33. Veneer placed on tooth.

Figure 34. Etch placed on left lateral.

Figure 35. Notice enamel etch.

Figure 36. Immediately post-op.

Figure 37. One year post-op.

Figure 38. Lingual view, one year post-op.

(Figure 16). There was pulpal involvement of both teeth and the patient was in quite a bit of discomfort. The pieces of the teeth were salvaged by his parents and brought to the office (Figure 17). It may have been possible to try a direct pulp cap (using a material such as TheraCal [BISCO Dental Products]), but because the parents were concerned about possible future problems with the teeth and related insurance issues, they wanted to have the root canals done. In order to provisionalize the case, the pieces would be bonded back in place prior to root canal therapy.

Clinical Protocol—The avulsed pieces were acid-etched (Ultra-Etch) along with the teeth (Figures 18 and 19). A 4th generation bonding system (ALL-BOND 3 [BISCO Dental Products]) was used due to its long track record of success. The ALL-BOND 3 primer was placed on the left central incisor (No. 9) intraorally (Figure 20) and the avulsed piece scrubbed for 20 seconds. This was air-thinned and light cured for 20 seconds. Care was taken to prevent any bleeding of the pulp. The ALL-BOND 3 adhesive was placed on the tooth and the fractured piece and air-thinned (Figures 21 and 22). This was not light cured, as it might not have gone to place due to the film thickness of the adhesive. A light-cure resin cement (Insure [Cosmedent]) was placed on the fractured piece (Figure 23) and taken to the mouth. The piece was lined up with the fracture (Figure 24) and the resin cement was cleaned with a brush prior to light curing. No preparation of the tooth was done so that it would line up as a butt margin. Figure 25 shows the avulsed piece attached to the natural left central incisor.

Next, the same protocol was followed for the lateral incisor (No. 10). Figure 26 shows the patient's aesthetics prior to endodontic treatment.

Once the pieces were attached, the endodontist saw the patient that same morning and performed endodontic therapy on both teeth. Composite resin was placed in the endo access openings. The patient was then appointed back with us a few weeks later to begin the definitive restorative phase (Figure 27). The sequencing of the treatment, as described, allowed the patient to have a pleasing appearance prior to finalizing the treatment.

For the veneers, feldspathic porcelain was to be used. The teeth were prepared with diamond burs (Brasseler USA), maintaining as much enamel as possible for maximum strength. A temporary made from composite was placed on the teeth prior to final veneer placement.

When the patient returned for seating of the restorations, cord was placed to displace the tissue and to control sulcular fluid (Figure 28). The veneers were placed individually. The left central was isolated with interproximal strips, and acid-etching gel was placed on the tooth for 20 seconds (Figure 29). There was ample enamel available for bonding (Figure 30). ALL-BOND 3 primer was placed on the tooth for 20 seconds (Figure 31), air-thinned, and light cured for 20 seconds. Next, All-BOND 3 adhesive was then placed on the tooth, air-thinned, but *not* light cured (Figure 32). Adhesive was placed in the veneer, along with the resin cement (Insure), then placed on the tooth (Figure 33). The excess resin cement was removed prior to light curing for easy cleanup.

Next, the lateral, with the prep that had been contained in enamel, was etched for 20 seconds (Figures 34 and 35). The primer was placed for 20 seconds, thinned with air, and light cured. The adhesive was once again placed on the tooth and inside the veneer along with resin cement. This was placed on the tooth, and the excess resin cement was removed prior to light curing the restoration.

The completed restorations are shown on the day after removing excess cement in Figure 36. The final restorations are shown at one-year postoperatively in Figures 37 and 38.

This case demonstrates a very conservative approach to treating a young patient who had many years to keep his teeth. If these teeth were prepared for crowns, I feel they would not have the longevity that these conservative veneers have to offer. The case is now 8 years old and maintaining very well.

CLOSING COMMENTS

While prevention is always the ultimate goal, noninvasive/minimally invasive dentistry is an obligation that we must always consider and offer to our patients when restorative work is required. Once the decision is made that a restoration is necessary, the clinical objective should always be to preserve as much tooth structure as possible.✦

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Disclosure: Dr. Margeas reports no disclosures.