

The Evolution of Universal Restoratives: A Leap Forward

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INTRODUCTION

A Brief Historical Background

It was Dr. Rafael Bowen who developed and introduced composite resin into dentistry in the early 1960s.¹ The transformation of composite not only took place due to this development but also because of its ability to bond to tooth structure, which was first researched and reported by Oskar Hagger² and then by Michael Buonocore.³ In the past, dental schools only taught 2 applications of composite restorations: Class III and Class V cavity preparations. During that time, etching took place only on enamel. Early on in the use of composite restorative materials, the choice was limited between 2 materials: Adaptic or Concise. The composites consisted of Paste A (base) and Paste B (catalyst) with no photoinitiators. These materials contained 70% to 80% quartz filler, and the particle size ranged from 1.0 to 40.0 μm . There was a major turning point in posterior direct composites when Nobuo Nakabayashi demonstrated the clinical acceptance of its bond strength to dentin.⁴ This may have been the most important factor in the development of adhesive dentistry and posterior composite restorations and it still is to this day. As a result of these material advances throughout time, we have seen the capability to replace amalgam with more aesthetic materials, more minimally invasive tooth preparations, and the minimum need for mechanical retention. This has allowed the clinician to restore posterior teeth that will maintain their occlusal strength and support.

For years, one of the main classifications of composites has been based on particle size: macrofill, small particle, microfill, microhybrid, nanofill, and nanohybrid. The newer developments in composites have resulted in materials that are more resistant to wear. Although composites have evolved considerably, most dentists still have dental composites that utilize Bowen's original methacrylate monomer system (or a close derivative). Composite resins are most commonly composed of dimethacrylate monomers (bisphenol A-glycidyl methacrylate, triethylene glycol dimethacrylate,

hydroxyethylmethacrylate, etc), a filler material (such as silica), and, in most current applications, a photoinitiator. As clinicians, we have always been concerned with the impact of composites and their initial shrinkage as it relates to marginal integrity, microleakage, and, in the end, the overall integrity and longevity of the restoration. The dental community—clinicians and manufacturers alike—continue to strive for the ideal composite resin material. This is not only in the aesthetic characteristics of the material, but in many other categories as well, including: chemistry, color stability, surface texture, marginal integrity, polymerization stress, biocompatibility, strength, density, wear, and ease of placement.

Recent Introduction of a Nano-ORMOCER Material

Admira Fusion (VOCO America) is the world's first all-ceramic-based direct universal, radiopaque, nano-ORMOCER (ORganically MOdified CERamic). Admira Fusion has no classic composite monomers, increasing its level of biocompatibility and eliminating the potential for such substances to be released after polymerization. The chemical base for all 3 products in the Admira Fusion line is silicon oxide. These 2 factors separate Admira Fusion from other composites and universal restoratives. The ORMOCER, which is used in place of conventional monomers, consists of larger and precondensed molecules of an inorganic matrix with a high degree of cross-linking. The degree of cross-linking allows virtually 100% of the molecules to link during polymerization and eliminates residual monomers, according to the company. The reason for the lower shrinkage is the larger and prepolymerized ORMOCER matrix and the high degree of fillers within Admira Fusion and **Admira Fusion x-tra** (4.0-mm bulk fill).

The case selections that follow are the typical cases with which clinicians are routinely presented. Our goal as clinicians, when indicated, should be to conservatively restore the teeth with long-lasting restorations.

CASE REPORTS

Case 1: Restoration of a Mandibular First Bicuspid

A 67-year-old patient presented with an existing (MO) amalgam restoration with marginal leakage and recurrent caries on tooth No. 20 (Figures 1 and 2). After clinical examination, it was decided to replace the restoration, remove all recurrent decay, determine if the distal should be restored, and clinically decide if the fracture lines present will need cuspal protection.

Clinical Protocol

A rubber dam (**Hygienic Dental Dam [COLTENE]**) was placed, the old amalgam restoration was removed, and the cavosurface margin enamel was beveled for long-term bond strength (Figure 3). Oftentimes, with the removal of an amalgam restoration, the pulpal floor and internal walls will show staining and fracture lines present at the internal line angles of the preparation. Upon completion of the preparation, it was decided that the fracture lines did not warrant cuspal coverage nor preparation of the distal contact because an acceptable amount of supportive dentin was present. This would allow the placement of a conservative bonded direct posterior composite restoration. Next, a matrix and wedge were placed on the tooth (the all-new **Composi-Tight 3D Fusion Sectional Matrix System** and **Composi-Tight 3D Fusion Fender Wedges [Garrison Dental Solutions]**) (Figure 4). A total-etch procedure was done. Then a 15-second etch on the cavosurface margins and a 10-second dentin etch of the preparation were done using 35% phosphoric acid-etching gel (**Ultra-Etch [Ultradent Products]**) (Figure 5). The etchant gel was then removed by rinsing with copious amounts of water for 15 to 20 seconds. A light stream of air and blot drying were used to maintain a moist preparation. (Note: avoid dehydrating the preparation to avoid postoperative sensitivity.)

Next, a universal bonding adhesive (**Futurabond U [VOCO America]**) was applied by utilizing a microbrush for 20 seconds, thoroughly scrubbing the preparation to ensure penetration into the etched enamel prism and dentin to form a good adhesive bond (Figure 6). The adhesive was then air dried to evaporate the solvent and uniformly thin it out. The air-thinned universal adhesive was then light cured (**VALO Grand [Ultradent Products]**) for 20 seconds. Next, a layer of **Admira Fusion Flow** (VOCO America) was placed, covering all internal aspects of the cavity preparation and ensuring adaptation of the first layer of material to the dentin and enamel of the cavity preparation. Incremental light-cured layers were then subsequently utilized in placing the Admira Fusion, with excellent adaptation to the cavosurface margins and interproximal contact. The anatomic form and morphology of the tooth was followed as the nano-ORMOCER material was placed. Figure 7 shows the final restoration.

Case 2: Restoration of Mandibular First and Second Bicuspids

A 52-year-old patient presented for a dental examination. One of the radiographs taken revealed a carious lesion on the mesial of tooth No. 20 and on the distal of tooth No. 21. Tooth No. 20 presented with an existing (DO) amalgam restoration with marginal leakage and recurrent decay. (Note: tooth No. 19 was missing and the future treatment plan would include an implant.) The same clinical protocol was followed, as outlined above for the first case presented, except a **SlickBand Tofflemire Matrix** (Garrison Dental

Solutions) was used because of the missing tooth No. 19 and due to the MOD preparation required in this case (Figure 9). Upon placement of the Admira Fusion, an occlusal adjustment and marginal finishing work were completed on tooth No. 20 prior to placing the restoration on tooth No. 21. Figure 10 shows the placement of the Garrison Composi-Tight 3D Fusion Sectional Matrix System on tooth No. 21. Incremental layering and curing was utilized for placement of the Admira Fusion. Occlusal adjustment and marginal finishing were completed. As with all restorations, the occlusion was marked with articulating paper and adjusted using composite finishing burs (FG H 274 and H 246 burs [Kerr]). The final finishing burs were used to maintain proper cuspal form and anatomic integrity to support and sustain occlusal harmony. The final polish and glaze were achieved using mini polishers (Rally Composite Mini Polishers [Garrison Dental Solutions]) (Figure 11). This polishing system has course to fine mini polishers that will impart an excellent final luster on the composite surface. Figure 12 shows the completed restorations.

CLOSING COMMENTS

Francis of Assisi is credited with the following quote, “He who works with his hands is a laborer. He who works with his hands and his head is a craftsman. He who works with his hands and his head and his heart is an artist.”

“Restore to Nature.” This is a popular phrase that you may have also heard.

With the physical properties of restorative materials available, using a systematic approach, clinicians have the capability to restore teeth to appear as natural as the day they erupted. Whenever and wherever possible, if the restoration can be created in a way that it cannot be detected, then the restoration and tooth will appear as one.

Although the placement of resin-based restorations is multistep and technique-sensitive, it is important that clinicians place anatomical restorations to sustain morphology, longevity, and support the occlusion. Wherever the location, anterior or posterior, the restoration carries your name. With close attention to details and by using artistic skills, we can exceed our patients’ expectations.

References

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Dr. Tomaro graduated from the University of Michigan School of Dentistry, where he also completed his bachelor and master of science degrees. He maintains a private practice in Las Vegas, Nev, and is also the previous director of clinics at the Las Vegas Institute for Advanced Dental Studies. As a member of Catapult Education, Dr. Tomaro teaches hands-on courses and is an international lecturer, a published author, and a consultant for dental laboratories and manufacturers. He can be reached at (702) 533-3336 or via email at atomaro@ameritech.net.