Bioactive materials support proactive dental care

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Resin bonding of the human dentition has become a “standard” in the United States and Canada. There are more than 80 different bonding systems on the market today. We have seen evidence evolve through multiple generations in an attempt to “simplify” the bonding process. Yet, as these agents have simplified, many in our profession have seen many challenges arise.

A significant number of reports in the literature have been showing that the “immediate bonding,” effectiveness of contemporary adhesives are quite favorable, regardless of the approach used however in the long term, the bonding effectiveness of some adhesives drops dramatically.1 The hydrophilicity that both etch-and-rinse and self-etch bonding agents offer initially in the dentin-bonding process becomes a significant disadvantage in terms of long-term durability.2

It is this hydrophilicity of simplified adhesive systems combined with other operator-induced challenges that contribute to these failures. Tay, Carvalho, Passy, et al. have reported repeatedly in the literature of this problem.3 They continue to report that these bonding agents do not coagulate the plasma proteins in the dentinal fluid enough to reduce this permeability. The fluid droplets contribute to the incompatibility of these simplified adhesives and dual-auto-cured composites in direct restorations and the use of resin cements for luting of indirect restorations. The term “water-tree” formation has been coined to describe this process, which originated from the tree-like deterioration patterns that were found within polyethylene insulation of underground electrical cables. It is now being applied to the water blisters formed by the transfer of dentinal fluid across the dentin-bonding interface. These “water blisters” act as stress raisers and form initial flaws that cause subsequent catastrophic failure along the adhesive composite interfaces.4

The previously mentioned plasma proteins are released by the dentin when subjected to acids and cause hydrolytic and enzymatic breakdown of the dentin and resin bonding agent interface.5 These enzymes are called matrix metalloproteinases (MMPs). Currently, there are only three methods of reducing these MMPs: 1. percent chlorohydric solutions that are used prior to application of bonding agents, etchants containing benzalkonium chloride, otherwise known as RBC (e.g., Risco’s Uni-etch products), and polyvinylphosphonic acid—producing products (glass ionomer and resin-modified glass ionomers). Due to the short efficacy of these chlorohydric solutions being used before bonding, this methodology has come into question as of late.6 Etchants with RBC have been shown to be valuable in the reduction of MMPs and should be considered in all bonding procedures. However, the most intriguing methodology of reducing MMPs and remineralizing tooth structure is with the use of glass ionomer cements (GIC) and resin-modified glass ionomers (RMGIC).

Glass ionomers and resin-modified glass ionomers

Glass ionomer cements have long been used as a direct restorative material. Their early formulations included the material difficult to handle, and they were, therefore, not ideal in an undesirable situation in dental restoration. However, these materials, which have been shown to significantly reduce microleakage, are quite favorable, regardless of the approach used. They have been shown to “significantly reduce microleakage along (the) axial wall of the restoration” and helps prevent bacterial invasion of the restored tooth. RMGIC biomaterials are multifunctional materials that can adhere to both tooth structure and composite resin, thus providing an improved sealing ability by chemical and macro-mechanical adhesion to enamel, dentin, cementum and composite resin.7,8

And like GICs, can be built filled to reduce the amount of composite necessary to restore the cavity preparation and act as dual-auto-cured composites in the restoration.9,10 The use of GIC and RMGIC in the restoration of posterior Class V restorations and conservative Class I restorations provide an improvement over traditional GICs.

They are easy to place and reasonably forgiving, even in a slightly moist environment. They have hold strength in a moist but not wet environment, so familiarity with technique is imperative as it is with all dental restorations.

I will often use Riva SC (SDI) or Fuji 9 GP Extra (GC America) in posterior When applied in a radical approach.11–13 Polishing and shaping of the materials must be done with water spray and fine air-tissue composites polishing burs and polishers so as not to destroy the surface of the material (Fig. 8).

The use of RMGIC products, such as Riva LC or Fuji II LC, is great in bicuspid and anterior Class V restorations, especially in high caries prone areas.14 Class II restorations, however, have always presented a challenge to the clinician. If the operator wanted to use GIC or RMGIC, there was no easy way to do that appeared to provide satisfactory results. It is with this in mind that the “sandwich technique” was developed.

It was thought that using the properties of GIC to bond to the tooth and then applying resin-bonding agents and composite to the set GIC could help reduce sensitivity and bond failures typically seen in many resin-bonded composite (RBC) techniques. Typically, the GIC is placed in the preparation, allowed to set, cut back to ideal form and then bonded to the tooth. The introduction of bondable glass ionomer materials has reduced the initiation of RBC techniques to the set GIC, even in the preparation of Class II restorations, thereby creating a bondable surface for the set GIC to adhere to. The materials by themselves are incompatible over the long term.

The modified sandwich technique evolved as a means to overcome this problem. Placing RMGIC over set GIC and then bonding composite to that — provided a better solution, but was laborious and time consuming to do, as is the sandwich technique.

The ‘Co-Cure Technique’

In 2006, an article was published4 that, in my opinion, has revolutionized the way I approach direct posterior restorations and direct restorations as a whole. The article provides a radial approach to direct posterior restorations, called the Co-Cure Technique. This technique is simple, yet very effective.

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I will often use Riva SC (SDI) or Fuji 9 GP Extra (GC America) in posterior restorations and conservative Class I restorations and composite resin for posterior Class V restorations.

In the Co-Cure Technique, the composite restorative does not require a...
bionding agent because the bonding agent is essentially the RMGIC. The RMGIC acts as the interface between the DEJ, then immediately place the

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