Evolving Conservative Dentistry

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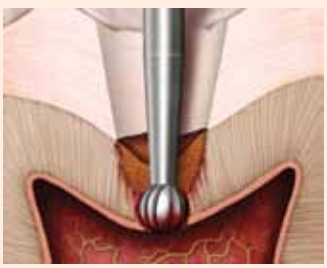
A mere 20 years ago, fourth generation adhesives revolutionized restorative dentistry by offering a predictable technique for bonding to both enamel and dentin.[1] Less than five years later, advances in ionomer and resin technologies provided clinically successful dentin and enamel replacement. In 2003, the first selective preparation burs that could differentiate healthy and unhealthy dentin were introduced.[2] These were all revolutionary innovations that significantly altered the practice of dentistry. Within a decade, adhesive-resin and composites had displaced amalgam as the mainstream restorative materials.

The intervening years have seen the development of improved fifth and seventh generation adhesives,[3,4] microhybrid and nanohybrid composites, LED curing lights, soft tissue lasers,[5,6,7] and a host of other adjunct technologies that make dental treatment better, easier, faster,[8] and more predictable.[9,10] These innovations have been evolutionary, rather than revolutionary, building upon the existing science by gradual improvement and facilitation.

The three major clinical concerns encountered by practitioners in recent years have included:
1. The end-point of cavity preparation (how to differentiate between infected and affected dentin and how much tooth structure must be removed to assure long-term operative success?)[11,12,13]
2. The disinfection of the prepared dentinal tissue (how to eliminate the remaining bacteria to prevent redecay?),[14,15] and
3. The facilitation and simplification of the restorative protocol (how to

FIGURE 1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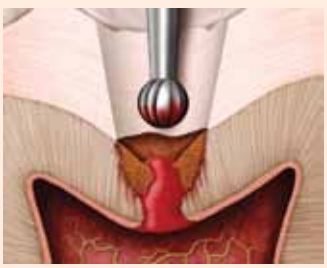
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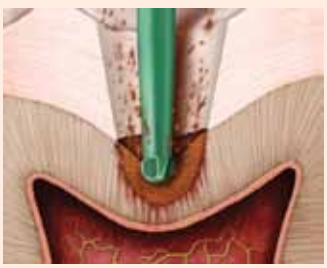
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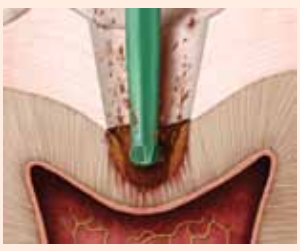
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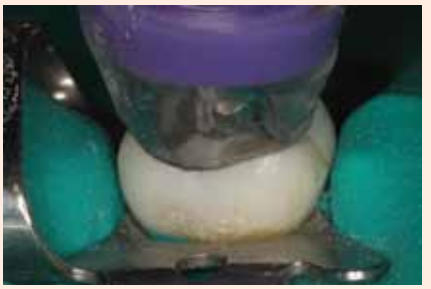

FIGURE 13

reduce the numerous steps and technique sensitivities that arise in the restoration of function and form?)

Recent technological advances have done much to allay these concerns and to move dental practice towards ever greater clinical predictability.

PREPARATION END-POINT

Second generation Smartburs II (SSWhite, Lakewood, NJ) are self-limiting polymer burs that have been developed to address the clinical problem of preparation endpoint: the removal of infected dentin (softened tooth structure that cannot be remineralized)[16] but the conservation of affected dentin (infected tooth structure that can be healed and remineralized). (Fig. 1) The slow speed Smartbur II relies on tooth structure hardness, and not tissue staining, to scientifically determine the endpoint. Its specifically designed Knoop hardness (harder than diseased dentin but softer than healthy dentin) allows the bur to selectively remove soft carious dentin while not cutting the harder healthy dentin.

A carbide or diamond bur can inadvertently penetrate through the thin remaining dentin into the pulp (Figs. 2, 3) the Smartbur II, on the other hand, is degraded by healthy dentin and ceases to cut (Figs. 4, 5). Smartburs II are used after the initial caries access preparation has exposed the deep, underlying caries. In cases where the caries is exposed (Fig. 6), these instruments can typically be utilized without the need for local anesthetics because they do not traumatize or open healthy dentinal tubules (Fig. 7).

CAVITY DISINFECTION

It is well established that some bacteria remain in the prepared tooth structures, no matter how thorough the preparation process, and despite a tactile firmness and non-stained

FIGURE 14

FIGURE 15

FIGURE 16

FIGURE 17


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FIGURE 22

appearance. It is now possible to greatly decrease the likelihood of viable bacteria beneath the restoration by chemo-therapeutic methods that can penetrate as far as 2-3mm into the remaining enamel or dentin. These techniques effectively destroy bacterial viability and permit the subsequent remineralization of compromised tooth structures.

• The technologies that have been shown to be effective surface bactericidals are:

Aseptim Plus (SciCan, Toronto, ON) Photo-Activated Disinfection System.[17] (Fig. 8)

This compact unit utilizes tolonium chloride to specifically stain liposomes in bacterial cell walls. The stain is subsequently targeted by a red diode light that releases oxygen ions. (Fig. 9) These ions break open the liposomes, rupturing the cell walls, and killing the bacteria.

• Ozonix (Biozonix, Munchen, Germany) Localized Ozone Generator. (Fig. 10) The ozone ions are generated in situ, and break down to oxygen molecules and oxygen ions. (Fig. 11) The ions are immediately, and selectively, toxic to bacteria. A very low level of ozone concentration is required for a comprehensive bactericidal effect.[18,19,20]

• Healozone (CurOzone USA, Aurora, ON). (Fig. 12) The ozone ions are generated remotely and introduced to the tip-sealed tooth surface through a handpiece. The high concentration of ozone is very effective in bacterial wall disruption and destroys them within 20-40 seconds.[21,22,23,24] (Fig. 13)

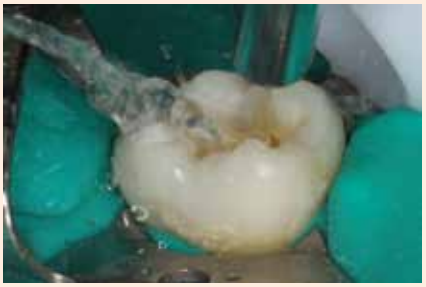
SIMPLIFICATION OF THE RESTORATIVE PROTOCOL

Most restorative protocols require numerous materials, each selected for particular beneficial properties, numerous steps, and a cumulatively complex description of the specific sequence that must be followed exactly. For example, microhybrid composites have excellent compressive strength for occlusal surfaces BUT they may not flow and adapt to margins and undercut areas of the preparation and can be difficult to sculpt. Flowable composites can adapt readily to the micro-anatomy of the tooth surface


FIGURE 23


FIGURE 24

FIGURE 25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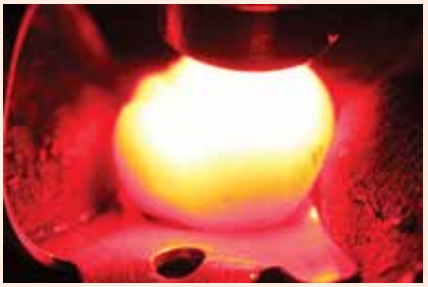
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FIGURE 28

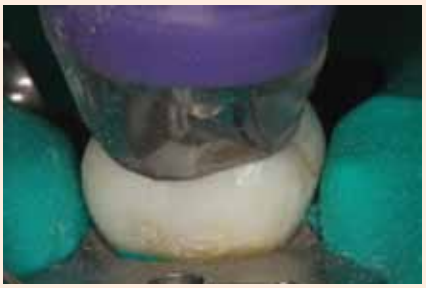
FIGURE 29


FIGURE 30


FIGURE 31

and are very polishable BUT cannot withstand the masticatory forces of direct occlusal contact.

Beautifil Flow Plus (Shofu, San Marcos, CA) introduces a new category of restorative material: the "injectable" flowable composite resin. (Fig. 14) Based on Giomer chemistry, it is neither a conventional composite nor a flowable resin; Flow Plus is a unique blend of these materials with the benefits of both. Its high strength resin matrix is densely packed by fillers optimized to 67%.

Beautifil Flow Plus F O3 has a higher yield point than other flowables; thus, it is not deformed by the strong occlusal forces placed on the posterior teeth. Due to its excellent physical properties, Beautifil Flow Plus is indicated for restoring both anteriors and posteriors, and it is suitable for the occlusal surfaces of posterior teeth.

Two viscosities are available, a sculptable non-flow (F 00) (Fig. 15) and a low-flow (F 03) (Fig. 16), which are used together in the Resin Cone Technique. Both are suitable for the occlusal surfaces of posterior teeth. The highly elastic Beautifil Flow F 10 is placed after the adhesive for interface stress relief. Then, the non-flow is injected to form cusps and marginal ridges. It injects smoothly from the syringe, holds its shape, and does not develop a dispensing "horn". Beautifil Flow Plus is not subject to technique sensitivity, and the Cone Injection Technique offers an important time advantage when compared to the layering technique. Beautifil Flow Plus 03 is placed last to finalize the occlusal anatomy of the restoration and to seal the marginal areas.

Used individually, or preferably together, these innovative techniques and materials provide practical clinical solutions to the concerns listed above. The following demonstration indicates an effective step-by-step protocol that incorporates the latest advances in restorative dentistry.

CLINICAL PROTOCOL

The rubber dam is punched and lubricated with water soluble Wink (Pulpdent, Watertown, MA) (Fig. 17) to facilitate its insertion through interproximal contacts without tearing. The Vita Easyshade Compact (Vident, Brea, CA) determines the shade of the restorative material at the beginning of the procedure, either before the rubber


FIGURE 32


FIGURE 33


FIGURE 34


FIGURE 35


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FIGURE 38


FIGURE 39

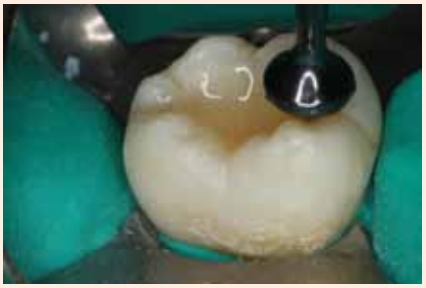
FIGURE 40

dam is placed, or immediately afterwards. (Fig. 18) It is important to record the shade while the tooth is still moist; once it is desiccated, the tooth will appear unnaturally chalky and opaque. The tooth is air-dried and the CarieScan PRO caries indicator (CarieScan, Dundee, United Kingdom) (Fig. 19) is utilized to confirm the location and the extent of the decay.[25,26,27,28] (Fig. 20)

Access through the enamel is developed with a Great White Gold #2 carbide[29] (Fig. 21) or a TDA #849 diamond (Fig. 22) high speed bur (both from SSWhite, Lakewood NJ).[30] Once the deep decay is exposed, The Smartbur II selectively removes the soft carious (infected) dentin. (Fig. 23) The structure of the Smartbur II is designed to automatically determine the preparation endpoint; any further rotation of the bur in the cavity simply abrades the bur, not the dentin. This leaves the harder, remineralizable (affected) dentin, covering the pulp chamber, intact. (Fig. 24)

The restorative process begins with an optional etching step; seventh generation adhesives do not require a separate etching step. A brief etch, 15 seconds or less, is unlikely to harm the bonding strength of the dental surfaces. Etch-Rite (Pulpdent, Watertown, MA) is applied to the enamel first and then the dentin (Fig. 25) and rinsed off with copious water less than 15 seconds later. (Fig. 26) Then, the prepared tooth surfaces are disinfected with the Aseptim Plus, (Fig. 27) Ozonics, (Fig. 28) or Healozone. (Fig. 29) Each of these treatments takes one minute or less of chairtime, and offers a greatly improved restorative predictability. Beautibond seventh generation single-component, single-step adhesive (Shofu, San Marcos, CA) is scrubbed onto all prepared dentin and enamel surfaces. (Fig. 30) It is left undisturbed for 10 seconds, and is then completely dried with an oil-free air syringe. (Fig. 31) The Beautibond is polymerized with a Fusion high power LED curing-light (DentLight, Richardson, TX). (Fig. 32)

Next, the cavity is filled utilizing the innovative resin Cone Technique (as opposed to the more laborious and time consuming layering technique). Sculptable Beautifil Flow Plus F 00 is injected onto the bonded surface of the preparation; (Fig. 33) the composite

is formed into cones at the bases of the buccal cusps (Fig. 34) as it adapts intimately to the preparation. Since Flow Plus 00 is a non-flow resin, it stays where it is placed until curing. The Beautifil Flow Plus 00 is then injected to form the cones at the bases of the lingual cusps, (Fig. 35) from cavity floor to the occlusal, until all four cusp bases are restored (Fig. 36). The injected cones are then polymerized with the Fusion curing light. (Fig. 37) Once the cone build-up is complete, Beautifil Flow Plus F 03 is injected to seal the marginal areas (Fig. 38) and the valleys between the cones. (Fig. 39) The BFF F 03 is a low-flow material that can readily be shaped by the Duckhead instrument (Hu-Friedy, Chicago, IL) (Fig. 40) prior to final light-curing. (Fig. 41) The Duckhead composite instrument minimizes (and in many cases, eliminates) the need for occlusal adjustment and polishing, further improving the efficiency of the restorative protocol. The completed restoration (Fig. 42) demonstrates the clinical result of the technique and material enhancements that are available to the practitioner today.

CONCLUSION

Innovations in end-point determination, cavity surface disinfection, and the simplification of restorative techniques have again revolutionized dental practice. Mainstream clinical procedures are better, faster, and easier, and much more predictable in the long-term. **OH**

FIGURE 41

FIGURE 42

Dr. George Freedman is a founder and past president of the American Academy of Cosmetic Dentistry, a co-founder of the Canadian Academy for Esthetic Dentistry and a Diplomate of the American Board of Aesthetic Dentistry. Dr. Freedman sits on the Oral Health Editorial Board (Dental Materials and Technology) is a Team Member of REALITY and lectures internationally on dental esthetics and dental technology. A graduate of McGill University in Montreal, Dr. Freedman maintains a private practice limited to Esthetic Dentistry in Markham, Canada.

Oral Health welcomes this original article.

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