Adhesive Dentistry and Endodontics: Materials, Clinical Strategies and Procedures for Restoration of Access Cavities: A Review

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Abstract

The complexity of restorative dentistry has increased greatly in recent years, with the myriad of products used in "adhesive dentistry." So too has the "simple" matter of restoring access cavities after completion of endodontic treatment. This review discusses current methods of "bonding" to tooth structure, ceramic materials, and metals, with emphasis on those aspects that are important to endodontics. Specific materials, procedures and major decision making elements are discussed, as well as how to avoid problems in compatibility between endodontic and restorative materials.

Key Words

Access cavities, adhesive dentistry, endodontics, restorative dentistry

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At the tomb of the unknown endodontist, there is a plaque that reads "Root canal treatment is not complete until the tooth has been restored." A recent article reviewed the overall topic of restoration of endodontically treated teeth (1). This review will address in detail the important issues when restoring access cavities through natural tooth structure and restorative materials with emphasis on major decision making elements, material selection and clinical procedures. It will focus on those aspects of adhesive dentistry that are important and unique to endodontics.

Contamination of the Root Canal System

One of the primary goals of root canal treatment is to eliminate bacteria from the root canal system to the greatest possible extent (2, 3). Bacteria have been shown to be the etiology for apical periodontitis (4) and to be the cause of endodontic failure (2, 3, 5). One of the goals in restoring of the tooth after root canal treatment should be to prevent recontamination of the root canal system. Gross contamination can occur during the restorative process from poor isolation or poor aseptic technique. Contamination can also occur from loss of a temporary restoration or if leakage occurs. The same things can occur with a "permanent" restoration, but "permanent" materials tend to leak less than temporary materials (6). Exposure of gutta-percha to saliva in the pulp chamber results in migration of bacteria to the apex in a matter of days (2, 7–9). Endotoxin reaches the apex even faster (10).

The importance of the coronal restoration in successful endodontic outcomes is widely accepted and has been supported by studies by Ray and Trope (11), Hommez et al. (12), Tronstad et al. (13), Iqbal et al. (14), and Siqueira et al. (2). However, studies by Riccuci et al. (15), Ricucci and Bergenholz (16), Heling et al. (17), and Malone et al. (18) indicate that contamination may not as important a factor in failure as is commonly believed. Therefore, it must be concluded that the significance of bacterial contamination as a cause of endodontic failure is not fully understood. Because there is clearly no benefit to introducing bacterial contamination into the root canal system, and since it may be a contributing factor in endodontic failure, a basic premise of this review will be that every effort should be made to prevent contamination.

Temporization

To minimize the likelihood of contamination, immediate restoration is recommended upon completion of root canal treatment (19–21).

When immediate restoration is not possible, and the tooth must be temporized, a thick layer of temporary material should be used, preferably filling the whole chamber. The majority of restorative dentists prefer a cotton pellet in the chamber, however (22). If a cotton pellet or sponge is to be use, orifice barriers are recommended, to provide a second layer of protection against contamination in addition to the temporary material at the occlusal surface.

Recommended procedure for placing orifice barriers:

1. Countersink the orifice with a round bur.
2. Clean the orifices and floor of the pulp chamber thoroughly with alcohol or a detergent to remove excess cement and debris. Air abrasion provides a dentin surface that is free of films and debris.
3. Place a temporary or "permanent" restorative material in the orifices and over the floor of the chamber.

A bonded material such as composite resin or glass ionomer cement is preferred (23–27). Temporary materials may also be used (28). Mineral trioxide aggregate (MTA) may also be used (29). There is probably some benefit to using a material that is clear so that the restorative dentist can see the underlying obturating material if re-entry is needed into the canal system (1) (Fig. 1).

Results varied in studies that evaluated temporary materials for the access cavities (21, 30–36). The most common materials tested were zinc oxide eugenol (such as IRM, Dentsply Int.), zinc oxide/calcium sulfate (Cavit, Premier Corp.) or resin based materials including composite resin and resin modified glass ionomer materials. Generally, all of the temporary materials were adequate if placed in a thickness of 3 mm or greater (21, 33–36).

All temporary materials leak to some extent (20, 21, 37–40). The zinc oxide/calcium sulfate materials are more resistant to microleakage than the zinc oxide eugenol materials (21, 34), probably because of setting expansion and water sorption (33). Although the zinc oxide eugenol materials tend to leak more, they possess antimicrobial properties, making them more resistant to bacterial penetration (21, 34, 41). Both materials are simple to use. One study reported less leakage with the use of two materials in combination (42).

Resin based temporary materials must be bonded to provide an effective seal, because they undergo polymerization shrinkage of 1 to 3% (30, 43). This is offset somewhat by the fact that they swell as they absorb water (30). Generally, bonded resin materials provide the best initial seal, but lack antimicrobial properties (30). They require more steps and more time to place than materials such as IRM or Cavit. Bonded resins are recommended for temporization that is likely to last more than 2 to 3 wk (42, 44). Resin modified glass ionomer materials are also a good choice for long term temporization, because they provide a bond to dentin and enamel, and many have antimicrobial properties (44).

Teeth requiring temporary post/crowns are a particular challenge, because of the difficulty in obtaining a good seal (45, 46). To minimize

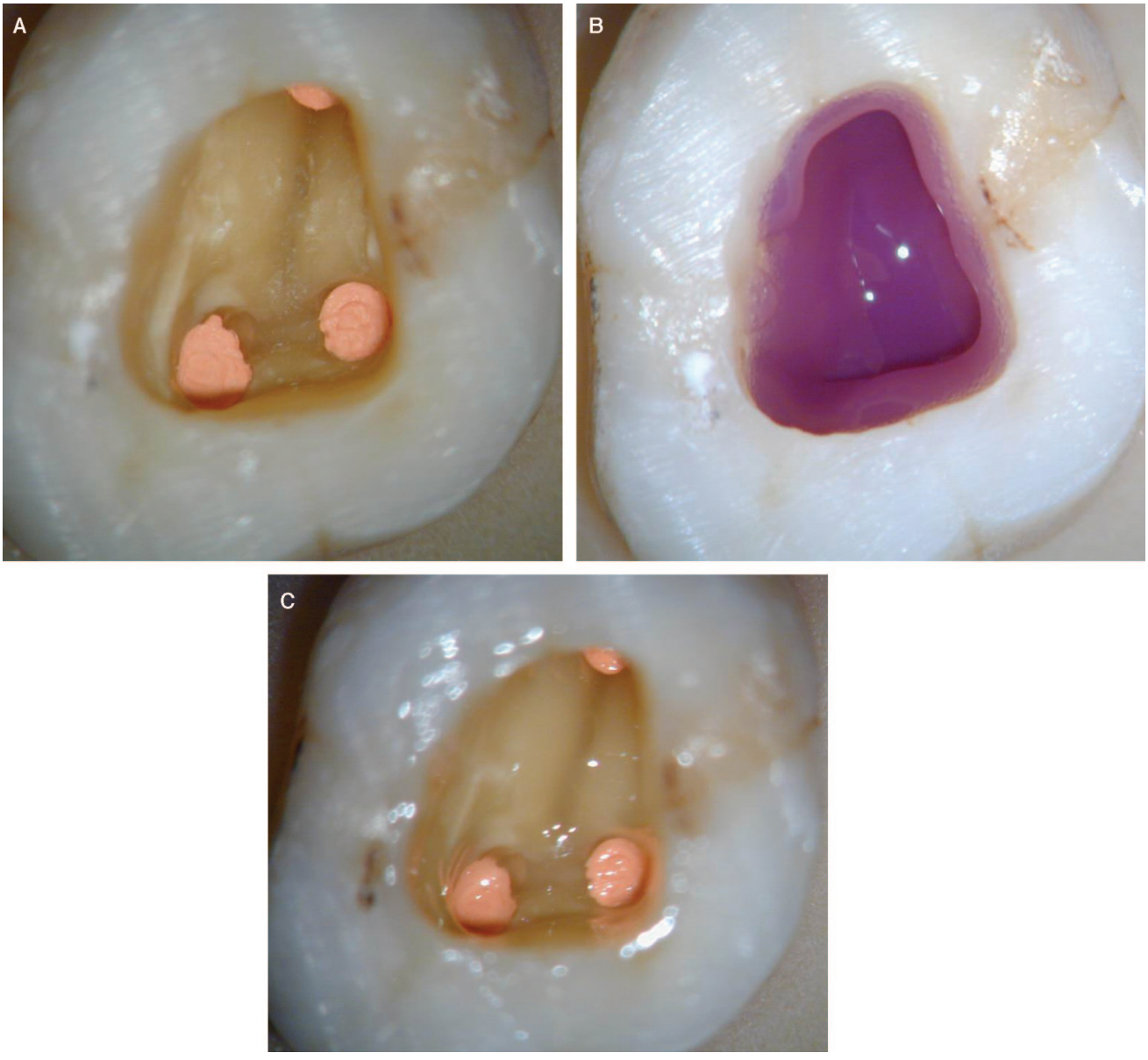

Figure 1. (A) The pulp chamber has been thoroughly cleaned. (B) There was 37% phosphoric acid applied to the orifices and floor of the chamber for 15 s. (C) The floor and orifices are sealed with unfilled resin. (Courtesy of Dr. Fred Barnett, Philadelphia.)