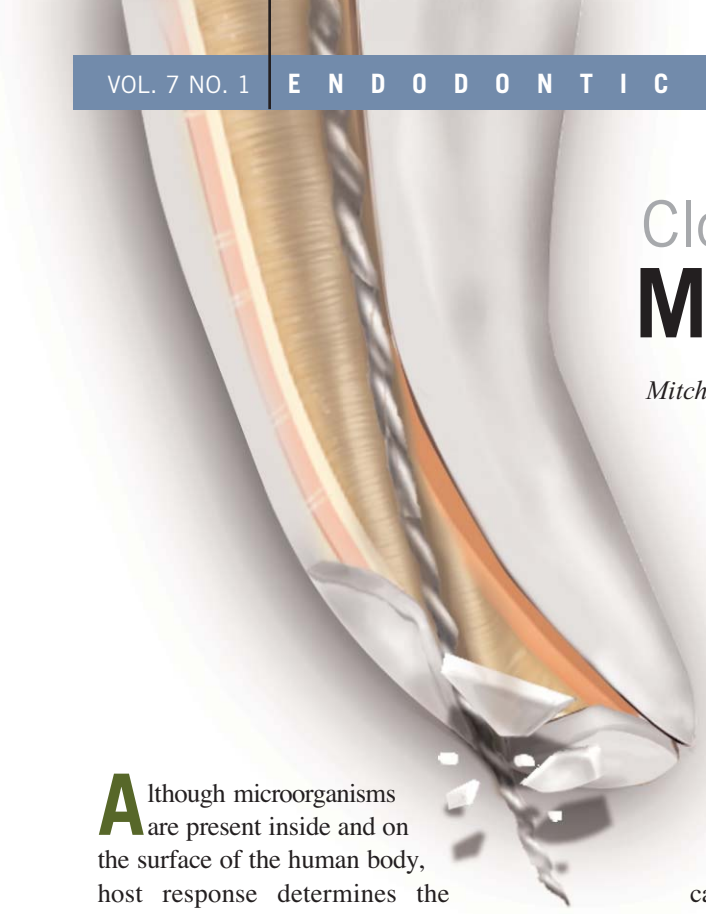

Closing the Door on Microleakage

*Mitchell H. Davich, DMD, FACD, FICD**

Although microorganisms are present inside and on the surface of the human body, host response determines the extent of illness these microorganisms may cause.[1] Similarly, periapical disease begins as an inflammatory reaction to microorganisms that escape from the root canal. Endodontic therapy endeavors to remove microorganisms, sanitize and seal the root canal space, and entomb remaining bacteria.

Microorganisms enter root canal systems directly through accessory canals or fractures. Apical periodontitis is a host reaction to these bacteria, biofilms, and their byproducts leaking from the root canal through portals of exit provided by the main apical foramen, furcation, and accessory canals. Sealing of these passages prevents microleakage, thereby encouraging periradicular healing (Figures 1A through 1C and Figure 2). Closing the door on microleakage is critical in four fundamental steps: pretreatment, foramen management, temporization, and restoration.

PRETREATMENT

It is essential to remove bacteria from the root canal system, while at the same time avoiding the introduction of new bacteria. Rubber dam isolation and pre-endodontic buildups are effective methods for decreasing the numbers and types of bacteria that are introduced into the root canal via salivary contamination. Pre-endodontic buildups are used when one or more axial walls of the tooth are missing. Amalgam, resin, and glass ionomers are acceptable materials to use in this process. A pretreatment buildup facilitates rubber dam placement, while offering a preview of the final restoration.

A rubber dam is the standard of care for safe and sterile isolation; otherwise the clinician is working in a salivary sea,

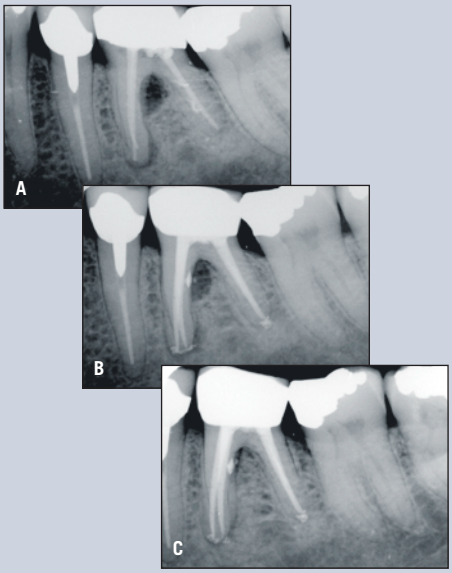

Figure 1A. Furcation and periradicular radiolucencies associated with failing root canal therapy. **Figure 1B and 1C.** Postoperative and recall retreatment films show sealed and healed apices with furcation canal.

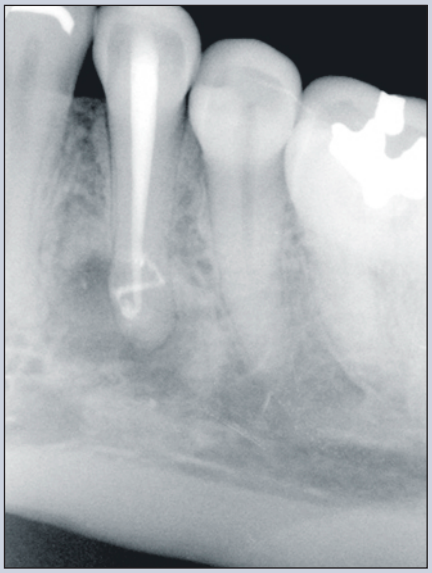

Figure 2. Obturation with multiple accessory canals.

Figure 3A. Loss of apical integrity from external resorption necessitated careful foramen management. **Figures 3B and 3C.** Postoperative and recall displays healing and re-establishment.

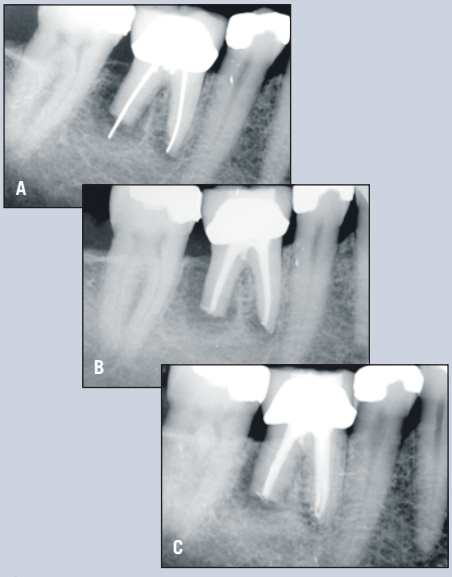

Figure 4A. Silver cone retreatment preoperative with apical resorption.
Figures 4B and 4C. Obturation and early recall demonstrates healing after careful foramen management.

Figure 5A. Traumatized teeth #8(11) and #9(21)with external resorption as well as wide and open apices. **Figure 5B.** MTA obturation after one year of successful CaOH therapy.

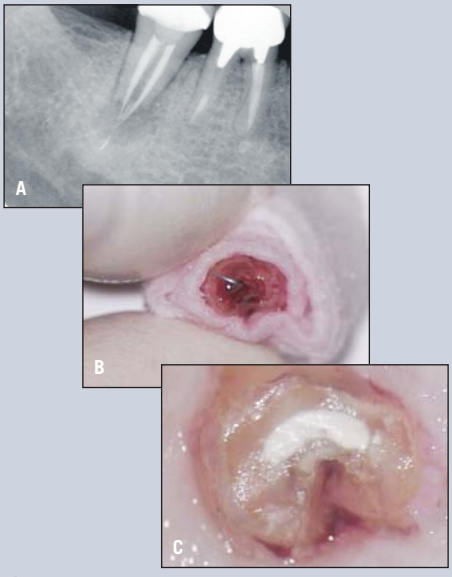

Figure 6A. Preoperative view of tooth #31(24) overfill. **Figure 6B.** Apical view after extraction with protruding plastic obturation carrier. **Figure 6C.** MTA retrofill after apicoectomy shows irregular C-shaped apex.

contaminating the operating field and inoculating bacteria into the root canal system. If it is not possible to properly isolate with the rubber dam, a clinician should consider crown lengthening.

For leakage around the clamp, doughnuts made of Cavit (3M Espe, St. Paul, MN), composite, and impression materials can be used, as well as caulking products (eg, Oraseal or Oraseal Putty, Ultradent, South Jordan, UT). Expasyl (Kerr Dental, Orange, CA) contains aluminum chloride and kaolin clay that provides hemostasis and malleability.

FORAMEN MANAGEMENT

The smaller the foramen, the smaller the door is to the host. Endodontic cases with vital pulps begin with a closed door (ie, the foramen diameter at apex approximates the tip of a 20-25 file). Overenlarging the apical foramen creates greater surface area for microleakage and allows for the introduction of microorganisms, bacterial byproducts, and other irritants. Instrumentation must keep the foramen as narrow as possible simultaneously maximizing the adjacent apical preparation diameter.[2-5]

Necrotic cases, previously instrumented cases, and those with external resorption represent another challenge. The foramen may be diffused, wide, without apical constriction, and difficult to identify. Combining multiple measurement techniques using radiographs, apex locators, and paper points can assist in finding the diameter and location of the apical terminus (Figures 3A through 3C and 4A through 4C).

When the foramen size is 90 or above, apical obturation with MTA should be considered (Figures 5A and 5B). Cases in which the foramen is irregular in shape present a challenge for manipulation of thermoplastic materials, and may lend themselves to other sealing techniques (Figures 6A through 6E).

Externally transporting or zipping the apex after accumulation of dentin sludge creates a larger elliptical surface area and inhibits proper sealing of the canal space (Figure 7). Frequent recapitulation and patency checks using various precurved file sizes coupled with copious irrigation help avoid this situation. A round apical preparation lends itself best to maximum corking with current obturation materials. Blocked foramina, although providing a mechanical seal, do not allow for complete cleansing of the root canal, thus leaving bacteria behind.

TEMPORIZATION

Cavit (3M Espe, St. Paul, MN), glass ionomer, intermediate restorative material (IRM), and TERM (Dentsply, York, PA) are common temporary restoratives. Each one excels in different situations; for prevention of microleakage, Cavit (3M Espe, St. Paul, MN) requires a minimum thickness of 4 mm, while IRM is susceptible to percolation under thermal cycling. Glass ionomer can be used as a long-term temporary and TERM (Dentsply, York, PA) may have some benefit when less than 4-mm thickness is available. Cotton pellets decrease the space available for temporization and therefore may play a role in promoting microleakage.[6]

A coronal seal is one of the most crucial factors in achieving success. When permanent restoration is to be delayed, Wolcott and Barr[6] recommend placement of an intraorifice barrier by

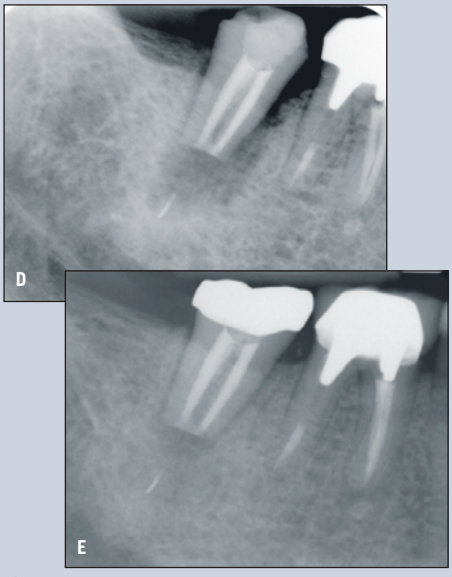

Figure 6D. Immediate post-replant is demonstrated. **Figure 6E.** Recall with healing in progress.

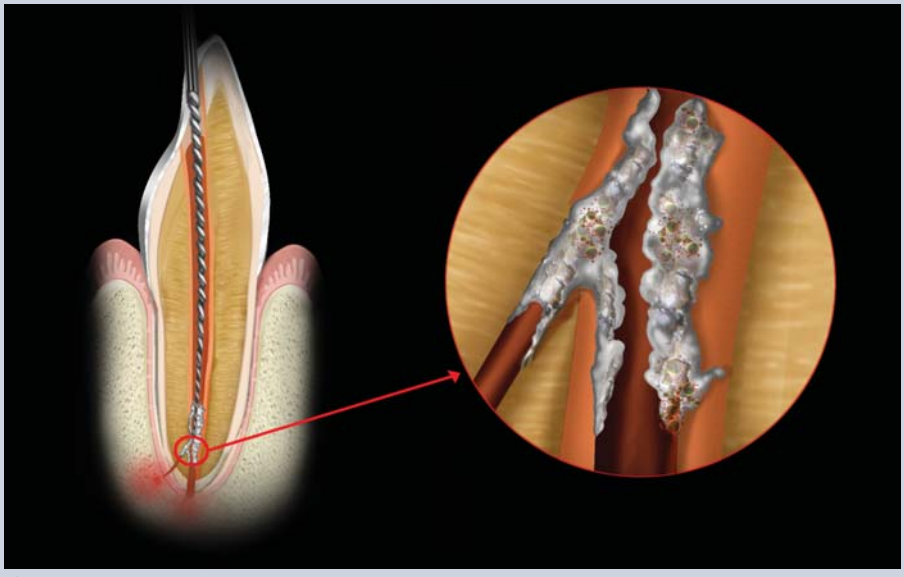

Figure 7. Zipping or external transportation of apex.

removing 2 mm to 4 mm of filling material below the canal orifice and filling the space with either temporary or permanent materials. Others suggest composite, glass ionomer, or resin ionomer orifice plugs as permanent microleakage barriers.[7,8] A layer of bonded, unfilled resin covering the pulpal floor also provides an effective barrier to bacterial leakage.[7]

PERMANENT RESTORATION

Provided that ample tooth structure remains, bonded composite restoratives and buildup materials minimize microleakage.[9] Use of these materials should be accomplished under the strict isolation of a rubber dam due to moisture susceptibility. If a post is necessary, self-cure or dual-cure resin luting agents with three-step adhesive systems currently provide the best seal, despite their technique sensitivity.[7]

The quality and sealing ability of a permanent restoration have a significant effect on the outcome of endodontic therapy.[10-13] Poor restorations can cause the best root canals to fail, and ideal restorations can allow substandard root canals to succeed. For microleakage prevention, the optimal time for endorestorative buildup is immediately upon obturation.

CONCLUSION

Bacterial microleakage is arguably the single most important risk factor for apical periodontitis. Closing the door on microleakage opens the door to more predictable and successful endodontic outcomes. ■

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