Management of Perforations: Four Cases from Two Private Practices with Medium- to Long-term Recalls

Marga Ree, DDS, MSc, and Richard Schwartz, DDS†*

Abstract

Introduction: Perforation repair is a fairly common endodontic procedure, but most of the recall data in the endodontic literature are short-term (ie, 1–2 years). The purpose of this article was to present 4 clinical cases of perforation repair with medium- to long-term recalls. **Methods:** Four cases were selected with different clinical scenarios. Three nonsurgical cases were retreated, repaired with mineral trioxide aggregate, and restored. The fourth case was strictly a surgical repair. Recalls up to 13 years are presented. **Results:** Perforation repair was shown to be successful in this case series, the teeth were preserved, and extraction was avoided. **Conclusions:** If managed properly, perforation repairs can result in long-term clinical success. *(J Endod 2012;38:1422–1427)*

Key Words

Case report, mineral trioxide aggregate, perforation repair, retreatment, surgery

From *Private Practice, limited to endodontics, Purmerend, The Netherlands; and †Private Practice, limited to endodontics, San Antonio, Texas.

Address requests for reprints to Dr Richard Schwartz, 1130 East Sonterra Boulevard, Suite 140, San Antonio, TX 78258. E-mail address: sasunny@satx.rr.com

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Perforations are unfortunate complications that occur in the course of endodontic treatment even for the most skilled clinicians. Not surprisingly, perforations are reported to result in lower success rates (1, 2). How they are managed can make the difference between retention and the loss of a tooth. Fuss and Trope (3) developed a classification of perforations as a predictor of prognosis. They described perforations that are small, within bone, and repaired immediately as having the best prognosis.

Mineral trioxide aggregate (MTA) is widely accepted as the preferred repair material for root perforations within bone (4). This is supported by case reports (5–9), animal studies (10–12), and retrospective studies (13, 14). Perforation repairs can be performed nonsurgically or surgically (14). Gray and white MTA are reported to work equally well (15, 16).

Several articles describe "long-term" follow-up of their cases (8, 9, 13), but they range only from 2 to 5 years. Other case reports present even shorter recall intervals. Long-term outcomes for perforation repairs are lacking in the endodontic literature. Therefore, the purpose of this case series was to present 4 perforation repairs performed in 2 private practices, 3 nonsurgical and 1 surgical, with 4.5- to 13-year recalls.

Patient #1

Patient #1 was a 13-year-old white female who was referred in 2005 for the evaluation and possible treatment of tooth #19. Her medical history was noncontributory. A clinical examination revealed that tooth #19 was restored with a large composite restoration, and there was a retained deciduous molar present mesially to tooth #19 with no permanent successor. The teeth were nontender to pressure and percussion, and there were no significant probing depths. A radiographic examination revealed periapical radiolucency associated with the mesial root of tooth #19. In addition, the mesiobuccal canal appeared to be transported and perforated (Fig. 1*A*). The endodontic diagnosis was previous root canal treatment with chronic apical periodontitis in tooth #19. The existing endodontic treatment was 4 years old.

The patient and her parents were presented with 3 options:

1. No treatment with eventual extraction of the tooth when it becomes symptomatic
2. Nonsurgical retreatment
3. Surgical treatment to repair the perforation and remove the root end

Because of the patient's age, a decision to retreat was made. The long-term goal of treatment was to preserve the tooth as a space maintainer until she was old enough to have it replaced by an implant.

Upon access, 2 perforations were discovered in the mesial root, a strip perforation in the coronal third on the furcal side and a lateral perforation in the apical one third. It took 2 appointments to remove the root canal filling and negotiate the original canals (Fig. 1*B*). After each appointment, the canals were dressed with calcium hydroxide (UltraCal XS; Ultradent, South Jordan, UT). At the third appointment, the mesial canals were obturated with MTA (ProRoot; Dentsply International, York, PA), and the distal canal was obturated with Resilon and Epiphany sealer (SybronEndo, Orange, CA) (Fig. 1*C*). At the fourth treatment session, a composite core material (Luxacore; DMG, Hamburg, Germany) was placed (Fig. 1*D*).

The 1-year recall showed a significant reduction of the periapical radiolucency (Fig. 1*E*). After 4.5 years, the tooth was doing well. It was decided to restore it with a crown. The final radiograph (Fig. 1*F*) and cone-beam computed tomographic slices

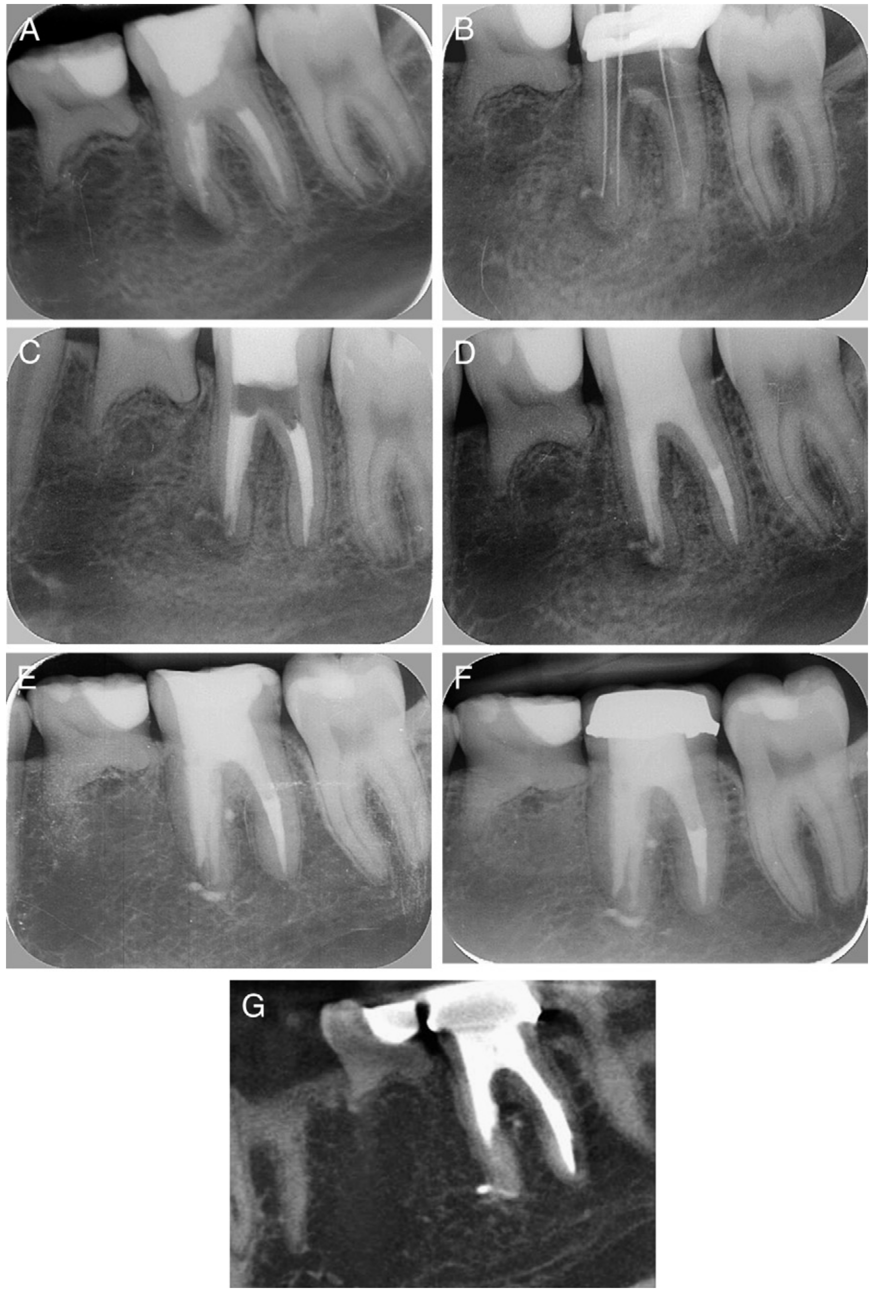

Figure 1. (*A*) A preoperative radiograph of tooth #19 showing radiolucency and a lateral perforation in the mesial root. (*B*) Working length determination is shown after removal of most of the root canal filling material. (*C*) The mesial canals were obturated with MTA, and the distal canal was obturated with Resilon and Epiphany sealer. (*D*) The tooth was restored with a fiber post in the distal canal and a composite core. (*E*) At the 1-year recall, there appeared to be a reduction of the size of the radiolucency. (*F*) At the 7-year recall, the patient was asymptomatic with normal function, and there was no evidence of endodontic disease. (*G*) At the 7-year recall, cone-beam computed tomographic imaging showed no evidence of endodontic disease in the apical or furcal areas. A slice through the furcation is shown with a centered alignment of the intersecting sagittal and frontal planes.

(Fig. 1*G*) (Kodak 9000 3D; Carestream Dental, Atlanta, GA) show the 7-year recall. The patient was asymptomatic, and there was no evidence of endodontic disease or significant probing depths. The patient is now 20 years old, and there are no immediate plans for an implant.

Patient #2

Patient #2 was a 41-year-old white woman who was referred in 2007 for the evaluation and possible treatment of tooth #2. Her general dentist had performed the original root canal treatment several years earlier. She had no significant medical history. Her chief complaint was biting tenderness associated with tooth #2. Clinical testing confirmed that tooth #2 was tender to pressure and percussion. There were no significant probing depths. A radiographic examination revealed apical and lateral radiolucency associated with the mesiobuccal root and a midroot perforation with extrusion of the filling material (Fig. 2*A*). The apical portion of the mesiobuccal root was not filled.

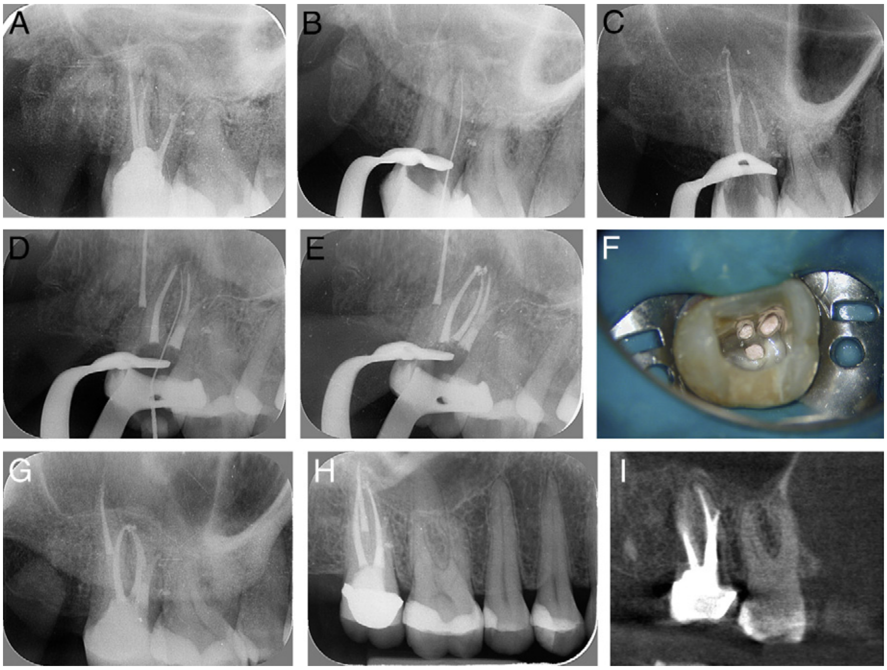

Figure 2. (*A*) A preoperative radiograph of tooth #2 showed periapical radiolucency and a midroot perforation. (*B*) The original mesiobuccal canal was negotiated. A file is shown at the working length. (*C*) The palatal and distobuccal canals were obturated with the Resilon system. The mesiobuccal canal was obturated apically to the perforation site with Resilon, and the rest of the canal, including the perforation, was obturated with MTA. (*D*) The mesiolingual canal was identified, and a file was placed to the working length. (*E*) The mesiolingual canal was obturated with Resilon and Epiphany. (*F*) A clinical photograph of the pulp chamber after obturation before restoration. (*G*) A final angled radiograph after obturation shows the repaired perforation site and a composite core. (*H*) At the 4.5-year recall, the radiograph shows a healthy crowned molar in full function. The tissue architecture appears to be normal on the mesial aspect of tooth #2. (*I*) At the 4.5-year recall, cone-beam computed tomographic imaging showed no evidence of endodontic disease. A sagittal slice is shown.

The tooth was restored with a composite restoration. The preoperative diagnosis was incomplete endodontic treatment with lateral perforation and chronic apical periodontitis.

Three treatment options were discussed with the patient:

1. No treatment with eventual extraction
2. Extraction now and replacement by an implant
3. Nonsurgical endodontic treatment with the possible need for surgery followed by restoration with a crown

The patient chose the third option.

At the first treatment session, the existing root canal filling was removed, and the apical portion of the mesiobuccal canal was located and negotiated with prebent hand files (Fig. 2*B*). All 3 canals were prepared to the working length, and calcium hydroxide was placed. At this point, no additional canals were observed.

At the second appointment, approximately 1 month later, the biting tenderness had subsided, but slight tenderness remained. Three options were considered to repair the perforation:

1. Obturation of the apical segment of the canal with Resilon and Epiphany sealer and then sealing of the perforation with MTA
2. Obturation of the entire mesiobuccal canal with MTA
3. Sealing of the perforation first with MTA while preserving the canal space apically to the perforation followed by obturation of the canals at a subsequent visit

MTA is a material with many benefits, but one of its disadvantages is that it is difficult to effectively apply in long narrow canals, so filling the whole canal with MTA was rejected. Because of the canal curvature, it would have been very difficult to get access to the perforation site while preserving the apical canal space with a space maintainer, such as a canal projector or a Resilon/gutta-percha cone. The first option was chosen.

A concern with this method was extrusion of obturating materials into the perforation site. This was avoided by cutting the cone to a length that would fill the apical portion of the canal short of the perforation site, buttering the tip of the cone with sealer, and placing it on a preheated plugger. Once the cone was seated, the downpack was performed using a System B heat source (SybronEndo). The other canals were obturated with Resilon and Epiphany sealer using System B and Obtura (Spartan Obtura Endodontics, Algonquin, IL). The rest of the mesiobuccal canal, including the perforation site, was filled with MTA (ProRoot) using Dovgan MTA carriers (Hartzell and Son, Concord, CA) and a West Perforation Repair instrument W3-4 (SybronEndo) (Fig. 2*C*). A moist cotton pellet was inserted on top of the MTA, and the tooth was temporized.

At the third appointment, a fourth canal, the mesiolingual, was located, instrumented (Fig. 2*D*), and dressed with calcium hydroxide. When the patient returned for the final appointment, she was asymptomatic. The mesiolingual canal was obturated with Resilon and Epiphany sealer (Fig. 2*E* and *F*), and the tooth was restored with a bonded composite core material (LuxaCore) (Fig. 2*G*). A crown was recommended.

At the 1-year recall, the patient was asymptomatic, and tooth #2 was restored with a crown. At the 4.5-year recall, the patient remained asymptomatic, and periapical radiographs showed no evidence of endodontic disease with normal tissue architecture (Fig. 2*H*). The computed tomographic scan (Kodak 9000 3D) showed possible evidence of a widened periodontal ligament at the apex of the mesiobuccal root (Fig. 2*I*).

Patient #3

Patient #3 was a 51-year-old white woman who was referred in 1999 with spontaneous pain and tenderness for 3 days that she localized to tooth #7. She was undergoing treatment for hypertension and high cholesterol and had a mild case of mitral valve prolapse. About a year earlier, endodontic treatment had been performed on tooth #7 followed by a post, buildup, and crown. A clinical examination revealed tenderness and mobility of 2. Probing was performed with anesthesia, and there were no probings deeper than 4 mm. Radiographs suggested a perforation at the end of the post (Fig. 3*A*). The diagnosis was previous root canal treatment with a normal periapex and lateral root perforation.

The following treatment options were discussed with the patient: (1) extraction or (2) removal of the post and possibly the crown to evaluate the perforation followed by a decision of whether to repair the perforation. The patient was advised that the second option might also include retreatment and a new crown. The patient chose the second option.

Access was made from the lingual aspect of tooth #7, and the metal post was removed. A mixture of blood and pus appeared immediately in the post space. After the drainage stopped, the post space was irrigated and dried and inspected under the microscope. It was decided to proceed with treatment. Shortly thereafter, the crown debonded from the tooth. The perforation was blocked with a cotton pellet, and the apical portion of the root canal was retreated using standard methods. A post space was created in the proper orientation. The perforation was then dried and repaired with MTA (Fig. 3*B*). A thick mix of MTA was placed in increments into the perforation tract. Each increment was condensed gently with a Dovgan plugger (Hartzell and Son) to a predetermined depth followed by condensation with the fat end of a paper point. The paper point absorbed excess moisture from the MTA and prevented extrusion of the material into the bone. Once the perforation was filled adequately with MTA, the tooth was temporized with a wet cotton pellet against the setting MTA.

Later that day, the patient's restorative dentist confirmed that the MTA was hard and placed a post/buildup and temporary crown. The patient's symptoms resolved within a few days, but she was monitored for 3 months in a temporary crown. During that time, she remained asymptomatic, mobility reduced, and the probing depths remained unchanged. Her restorative dentist then fabricated a new crown (Fig. 3*C*).

The patient was seen at 6 months, 6 years (Fig. 3*D*), and 13 years (Fig. 3*E*) for recall appointments. She was asymptomatic throughout. Tooth #7 had minimal mobility and no pockets deeper than 3 mm. The soft tissues looked healthy and normal, and the tooth and adjacent bone looked normal radiographically. At the last recall, the area was imaged with a cone-beam computed tomographic scan (Kodak 9000 3D). It showed no evidence of endodontic disease (Fig. 3*F*). The area adjacent to the perforation consisted of soft tissue with bone against the adjacent apical root surface.

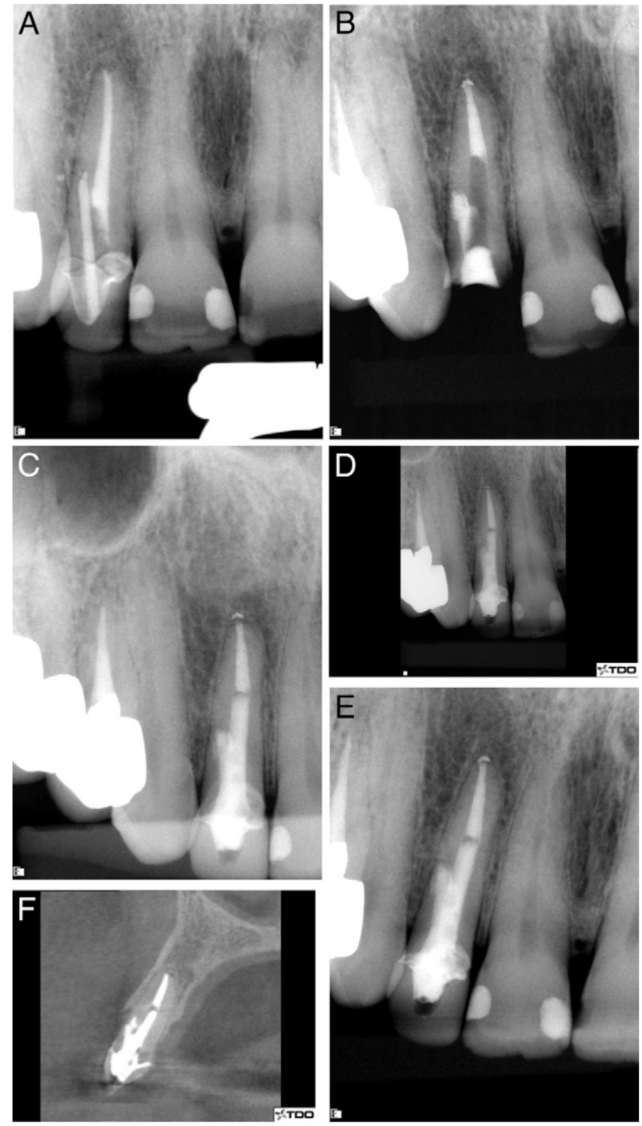

Figure 3. (*A*) A preoperative radiograph of tooth #7. The patient's symptoms and preoperative radiographs were suggestive of a perforation. (*B*) After disassembly, the perforation was visualized and cleaned and repaired with MTA. (*C*) After completion of endodontic procedures, a post and buildup were placed. The patient was held in a temporary crown for 3 months for observation and then restored with a ceramic crown. (*D*) At the 6-year recall, the patient was asymptomatic with normal function on tooth #7. (*E*) At the 13-year recall, the patient was asymptomatic and continued to function normally. (*F*) At the 13-year recall, cone-beam computed tomographic imaging showed soft-tissue coverage of the perforation site and no evidence of endodontic disease. A sagittal slice is shown.

Patient #4

Patient #4 was a 46-year-old white man who presented in 1999 with no symptoms. His medical history was noncontributory. A clinical examination revealed that tooth #7 was restored with a metal-ceramic crown of good quality. The teeth were nontender to pressure and percussion, and there were no significant probing depths. A radiographic examination revealed periapical radiolucency. In addition, there was lateral radiolucency that appeared to be the result of a perforation during post space preparation (Fig. 4*A*). The endodontic diagnosis was previous root canal treatment with periapical and lateral periodontitis. Historical records and radiographs were obtained and showed that during root canal treatment in 1984 perforation had occurred during post space preparation. The canal space and perforation were filled with gutta-percha and sealer. A cast post and core were fabricated and cemented, and a metal-ceramic crown was placed.

The patient was presented with 4 options:

1. No immediate treatment with eventual extraction of the tooth should it become symptomatic
2. Extraction and replacement with an implant
3. Nonsurgical endodontic retreatment followed by a new crown
4. Surgical treatment to repair the lateral perforation and perform root-end surgery

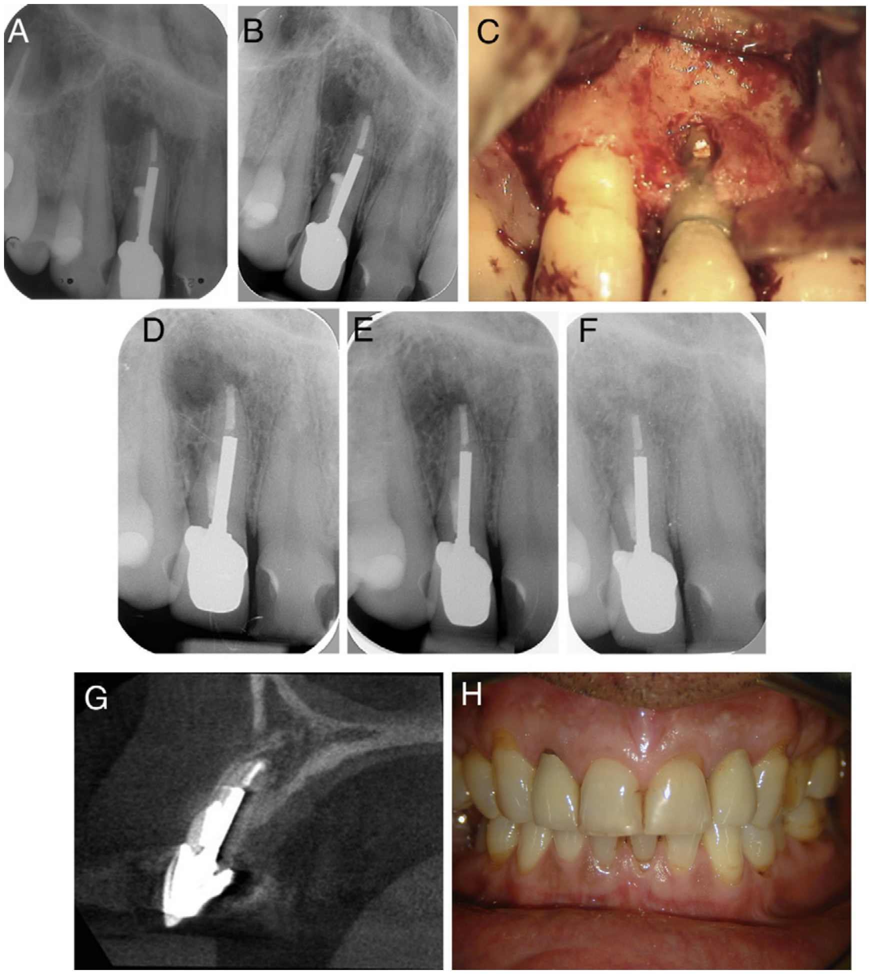

Figure 4. (*A*) A radiograph taken in 1999 showed periapical and lateral radiolucencies. The original treatment had occurred in 1984, and the treating dentist had filled the perforation with gutta-percha. (*B*) A radiograph of tooth #7 in 2003 before endodontic surgery. The lateral and apical radiolucencies did not appear to have reduced in size. (*C*) Surgical access was made with a full-thickness flap, the area was debrided, and the perforation site was visualized. (*D*) The perforation and root-end preparation were filled with MTA. (*E*) At the 1-year recall, there was a reduction of both radiolucencies. (*F*) At the 8-year recall, periapical radiographs showed no evidence of endodontic disease. (*G*) At the 8-year recall, cone-beam computed tomographic imaging showed no evidence of endodontic disease. A sagittal slice is shown. (*H*) A clinical photograph showing the metal-ceramic crowns 28 years after placement.

Because the patient had no symptoms, he postponed his decision, and it was not until 2003 that he opted for the surgical approach (Fig. 4*B*).

To get access to the lateral perforation, an intrasulcular incision was made, and a labial full-thickness flap was reflected (Fig. 4*C*). The gutta-percha in the perforation site was removed, and a preparation was made in the distal wall of the root using an ultrasonic diamond tip (KiS tip #1, Spartan Obtura Endodontics). A root-end resection was performed followed by a root-end preparation using the same ultrasonic tip. After obtaining a dry field, the lateral and apical preparations were filled with MTA (ProRoot) (Fig. 4*D*). The flap was repositioned and sutured.

Healing was uneventful, and the 1-year recall showed a significant reduction of the periapical lesion and normal tissue architecture at the lateral aspect of the root (Fig. 4*E*). The final periapical radiograph and cone-beam computed tomographic imaging (Kodak 9000 3D) were performed at the 8-year recall (Fig. 4*F* and *G*). The patient was asymptomatic, the clinical and radiographic presentations were unremarkable, and there was no evidence of endodontic disease. At the time of this writing, the crown had been in place since 1984, approximately 28 years (Fig. 4*H*).

Discussion

These cases and others (5–9) show that perforations can be repaired successfully with MTA but that is only part of the consideration that should go into treatment planning. For perforation repairs, it is important to also consider the periodontal and restorative prognosis of the tooth. There is little benefit to the patient if the endodontic treatment is successful, but the tooth fails for other reasons. As with any tooth for which endodontic treatment is considered, careful evaluation of structural integrity, restorability, and occlusal loads should be performed before endodontic procedures are undertaken. Also, the quality of the restorative treatment is likely to have a big impact on the long-term success or failure of treatment and should be part of the preoperative assessment and decision process.

The authors generally believe that endodontic treatment should not be completed until all clinical signs are resolved and the patient is asymptomatic. Patients #1 and #2 could have been completed in fewer appointments, but the author delayed final obturation until the patients were asymptomatic. Patient #3 was an exception because of temporization and esthetic considerations. When the crown came off, temporization became an issue. A temporary post and crown would have precluded the placement of a wet cotton pellet against the setting MTA, which was considered to be a requirement for MTA at the time. Secondly, a temporary post and core have been shown to provide a poor seal (17, 18). The author retreated the apical segment and repaired the perforation in 1 appointment, and the patient went to his restorative dentist about 4 hours later for a post/buildup and temporary crown. The author and restorative dentist decided this was the best approach in this case. It allowed confirmation that the MTA was hard, minimized contamination issues, and limited the time the patient had to go without a front tooth.

For patient #3, it could be debated whether the existing root canal treatment needed to be retreated because there was no evidence of periapical pathosis. The author did so because of the convenience of doing it at that point in treatment and in the hope of lowering the probability of future endodontic failure.

Cone-beam computed tomographic imaging was performed at the last recall appointment for each patient and in each case appeared to show complete healing. Representative slices were included in the figures. In patient #3, the authors were hoping to see bone covering the perforation repair as was seen in patients #1 and #2. However, the volume shows only soft tissue. Nonetheless, no pockets deeper than 3 mm were detected when probing with anesthesia 13 years after treatment.

In cases #1 and #2, the teeth were restored with composite restorations, but "definitive" full-coverage restorations were delayed. The authors commonly monitor patients with compromised teeth for 3 to 6 months to assess the outcome of endodontic treatment before committing the patient to additional expensive dental procedures. There is some risk to this practice, but the immediate placement of sound foundation restorations and careful management of the occlusion minimize the risk. Four cases were presented showing that perforations can be repaired with medium- to long-term success.

Acknowledgments

The authors deny any conflicts of interest related to this study.

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