

Case Report

Ultrasonic irrigation of a maxillary lateral incisor with perforation of the apical third of the root

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Abstract: We describe the successful use of a combination of nonsurgical root canal treatment and ultrasonic irrigation for collaborative management of a maxillary left lateral incisor with perforation of the apical third of the root. During the endodontic treatment procedure, the ultrasonically activated tip was used for intracanal irrigation. The area of perforation in the apical third of the root and the main root canal space were obturated with gutta-percha and root canal sealer, using a lateral condensation method. A follow-up clinical and radiographic examination at 5 years after treatment showed an asymptomatic tooth with excellent osseous healing. (J Oral Sci 52, 659-663, 2010)

Keywords: endodontic treatment; periradicular lesion; root perforation; ultrasonic irrigation.

Introduction

Root perforation is a common complication of endodontic treatment and post preparation, and often leads to tooth extraction. The prognosis for root perforations depends on the size and location of the defect, the length of time the perforation was exposed to contamination, and the ability to hermetically seal the defect (1). Generally, nonsurgical root canal treatment is indicated for the management of root perforations; surgical intervention is

reserved for cases that either have not responded to nonsurgical treatment or require concomitant management of the periodontium.

Perforation of the apical third of the root can result from failure to negotiate the curvature of roots. Endodontic instruments attempt to straighten themselves in these root canals, thereby causing iatrogenic root perforation (2). Clinically, perforations of the apical third of the root should be treated using the same standard endodontic principles used for regular root canals. In most cases, the main difficulty is accessing and adequately treating the main root canal.

This case report describes the treatment of a maxillary left lateral incisor with a perforation of the apical third of the root and an associated periradicular lesion. A combined approach involving both nonsurgical root canal treatment and ultrasonic irrigation resulted in healing of the associated periradicular lesion.

Case Report

A 41-year-old man with a noncontributory medical history was referred for endodontic treatment of his maxillary left lateral incisor. The referring practitioner had initiated root canal treatment and placed a calcium hydroxide paste in the root canal because of pulpal necrosis and root perforation. Clinical examination showed that there was a sinus tract related to tooth 22 (Fig. 1). There was some discomfort on percussion and slight pain on palpation of the periapical area. Radiographic examination of tooth 22 showed an incomplete root canal filling and a radiolucent lesion on the distal surface of the apical third of the root (Fig. 2). In addition, radiopaque material was observed in the lateral periradicular lesion. Based on these findings,

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a diagnosis of pulp necrosis and chronic apical periodontitis was made for tooth 22. The treatment plan comprised instrumentation of the root canal of tooth 22 and sealing of the perforation defect. After isolation of tooth 22 with a rubber dam, the pulp chamber was opened and the filling materials were removed with a size #25 Hedstroem file.



Fig. 1 Preoperative clinical view of a maxillary lateral incisor showing a sinus tract on the mucosa and a temporary crown.



Fig. 3 The master gutta-percha cone was placed in the root canal.



Fig. 2 Preoperative radiograph of tooth 22 showing inadequate root filling material, periradicular radiolucency, and some extrusion of material at the perforation site.



Fig. 4 Radiograph immediately after root canal filling with gutta-percha and root canal sealer.



Fig. 5 Two-year follow-up radiograph of tooth 22.



Fig. 6 A 5-year follow-up radiograph of tooth 22 reveals excellent resolution of the peri-radicular lesion.



Fig. 7 Postoperative view of tooth 22 shows satisfactory aesthetic results.

The working length was established and recorded. The main canal and the perforation area were instrumented to a size #40 K-file. Copious irrigation with 2.6% sodium hypochlorite solution was used throughout the procedure. There appeared to be a perforation of the distal wall several millimeters from the apex, as bleeding was consistently noted near that area when drying with paper points; however, the perforation was not associated with pain. The access opening was then sealed with Cavit (ESPE, Seefeld, Germany). Despite several attempts, root canal retreatment was not effective. During this period, the main root canal was negotiable, but the root canal could not be completely dried because of continuous exudation and hemorrhage. Residual infection was suspected, and adequate sealing was impossible at the perforation site. Therefore, it was decided that ultrasonic irrigation be used for intracanal disinfection. The root canal was cleaned with an ENAC ultrasonic tip (ST 21, ENAC OE-W10, Osada Co, Tokyo, Japan). The tip was placed 1 mm short of working length, the ENAC OE-W10 unit was activated at level 3, and the tip was worked using a push-pull circumferential motion for 1 minute. After completion of ultrasonic irrigation, additional irrigation was performed using 2.6% sodium hypochlorite and 17% EDTA. Two months after the procedure, the patient was comfortable. No sinus tract was present and root canal exudation had disappeared. After this, the main canal and perforation area were obturated by lateral condensation of gutta-percha and zinc oxide-eugenol sealer (Canals, Showa Yakuhin, Tokyo, Japan; Fig. 3). A postoperative radiograph was then taken (Fig. 4), and the patient was sent to the referring practitioner for further coronal restoration. The recall radiographs at 2 and 5 years show osseous repair, and the patient is asymptomatic at this writing (Figs. 5-7).

Discussion

Successful treatment of root perforations depends on adequately treating infection at the perforation site. In general, the prognosis for root perforations in the apical third of roots is much better than for those in the cervical third (3). In principle, these perforations are treated as any other communication with the periodontal space, such as the apical foramen or accessory canals. However, perforation of the apical third of the root is challenging with respect to diagnosis and treatment planning. It is important to determine the exact location and accessibility of the perforation site before a correct treatment approach can be formulated. In the present case, conventional root canal treatment did not appear to eliminate infecting bacteria from the main canal or the perforation site. Recently, various instrumentation techniques (such as increased apical instrumentation size) (4), the use of calcium hydroxide as an interappointment medication (5), and the utilization of alternative irrigants (6) have been suggested as means of further reducing bacteria. In addition, the use of ultrasonics has been proposed as a possible solution to the problem of debriding and disinfecting the root canal system (7). Carver et al. (8) showed that ultrasound after completion of hand or rotary instrumentation reduced the number of bacteria. Thus, in the present case, we used a combined approach involving both hand instrumentation and ultrasonic irrigation of the involved tooth, and the result was satisfactory. In this case, 1 minute of ultrasonic activation appeared sufficient to produce a clean main root canal and perforation area (8,9). A shorter duration of passive irrigation makes it easier to maintain the tip in the center of the root canal, thus preventing it from touching the root canal.

Traditionally, large root perforations have been treated nonsurgically in a manner similar to apical closure of immature apices, using the mineralization potential of calcium hydroxide (3,10). The exact mode of action of calcium hydroxide is still a matter of discussion, but it is clear that repeated dressings with the material lead to hard tissue barrier formation. However, the quality of the resulting mineralized barrier is unknown and may not be sufficient to sustain the forces applied when obturating the root canal. In the present case, the referring practitioner had initiated root canal treatment and placed a calcium hydroxide paste in the root canal. However, a calcium hydroxide medication was insufficient for adequate cleaning and sealing of the main root canal and perforation site. Mineral trioxide aggregate (MTA) has been used instead of calcium hydroxide for apexification of immature roots because it facilitates normal periradicular architecture by inducing hard tissue barriers (11). MTA has also resulted

in promising outcomes when used for the repair of lateral and furcation perforations (12). In our patient, the perforation defect was located in the apical third of the root, where the use of MTA was difficult to control. A simpler procedure is conventional lateral condensation technique using a master gutta-percha cone that exhibits adequate fitting at the apical portion. In lateral condensation technique, the master gutta-percha cone does not always correspond to the shape of the instrumented root canal and therefore the space left between the gutta-percha cone and the dentinal walls is filled with sealer. However, since most of the root canal sealers are resorbable, it is reasonable to assume that the obturation obtained by lateral condensation technique will deteriorate with time. Therefore, the volume of sealer in the root canal should not be large, and a very thin layer of sealer is preferred (13). The present case demonstrates that perforation of the apical third of the root can be effectively sealed by means of lateral condensation technique. The ability to replace surgical treatment with conservative root canal treatment in combination with ultrasonic irrigation would be of great benefit to patients.

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References

1. Lemon RR (1992) Nonsurgical repair of perforation defects. Internal matrix concept. *Dent Clin North Am* 36, 439-457.
2. Alhadainy HA (1994) Root perforations. A review of literature. *Oral Surg Oral Med Oral Pathol* 78, 368-374.
3. Fuss Z, Trope M (1996) Root perforations: classification and treatment choices based on prognostic factors. *Endod Dent Traumatol* 12, 255-264.
4. Card SJ, Sigurdsson A, Orstavik D, Trope M (2002) The effectiveness of increased apical enlargement in reducing intracanal bacteria. *J Endod* 28, 779-783.
5. Peters LB, van Winkelhoff AJ, Buijs JF, Wesselink PR (2002) Effects of instrumentation, irrigation and dressing with calcium hydroxide on infection in pulpless teeth with periapical bone lesions. *Int Endod J* 35, 13-21.
6. Shabahang S, Torabinejad M (2003) Effect of MTAD on *Enterococcus faecalis*-contaminated root canals of extracted human teeth. *J Endod* 29, 576-579.
7. Gutarts R, Nusstein J, Reader A, Beck M (2005) In

- vivo debridement efficacy of ultrasonic irrigation following hand-rotary instrumentation in human mandibular molars. *J Endod* 31, 166-170.
8. Carver K, Nusstein J, Reader A, Beck M (2007) In vivo antibacterial efficacy of ultrasound after hand and rotary instrumentation in human mandibular molars. *J Endod* 33, 1038-1043.
 9. Sabins RA, Johnson JD, Hellstein JW (2003) A comparison of the cleaning efficacy of short-term sonic and ultrasonic passive irrigation after hand instrumentation in molar root canals. *J Endod* 29, 674-678.
 10. Foreman PC, Barnes IE (1990) A review of calcium hydroxide. *Int Endod J* 23, 283-297.
 11. Giuliani V, Baccetti T, Pace R, Pagavino G (2002) The use of MTA in teeth with necrotic pulps and open apices. *Dent Traumatol* 18, 217-221.
 12. Mente J, Haga N, Pfefferle T, Koch MJ, Geletneky B, Dreyhaupt J, Martin N, Staehle HJ (2010) Treatment outcome of mineral trioxide aggregate: repair of root perforations. *J Endod* 36, 208-213.
 13. Kontakiotis EG, Wu MK, Wesselink PR (1997) Effect of sealer thickness on long-term sealing ability: a 2-year follow-up study. *Int Endod J* 30, 307-312.