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CASE REPORT/CLINICAL TECHNIQUES

Clinical Management of a Maxillary Lateral Incisor With Vital Pulp and Type 3 Dens Invaginatus: A Case Report

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A maxillary right lateral incisor with a type 3 dens invaginatus and a large periapical lesion with vital pulp in a separate root canal was treated both nonsurgically and surgically. Care was taken not to expose or devitalize the vital pulp in the main root canal system during the treatment. The signs and symptoms ceased after the treatment, and 4-month recall showed complete bone healing with pulp vitality maintained.

Dens invaginatus is a rare malformation of teeth with a broad spectrum of morphological variations. The affected teeth present with an infolding of enamel and dentin, which may extend into the pulp cavity, into the root, and sometimes to the root apex (1). Several theories have been proposed for this phenomenon, but the etiology of dens invaginatus remains unclear. Kronfeld (2) proposed that dens invaginatus is caused by a focal failure of growth of the internal enamel epithelium leading to proliferation of the surrounding normal epithelium with eventual engulfment of the static area. Oehlers (3) proposed that distortion of the enamel organ occurs during tooth development and results in protrusion of a part of the enamel organ. Other theories include infection (4), trauma (5), and genetics (6) as possible contributing factors.

Oehlers (3) classified these malformations into three types. Of particular interest in his classification is type III, in which an enamel and/or cementum-lined dens forms tracks through the root and perforates in the apical area to form a second foramen but has no direct communication with the pulp. The purpose of this article is to discuss the clinical management of this particular variant of the dens invaginatus form.

CASE REPORTS

A healthy 24-year-old man was referred to the author's private practice with the chief complaint of a gum boil above the upper right front tooth. The patient had no significant medical history. Clinical examination revealed an intraoral sinus tract in the labial gingiva adjacent to the maxillary right lateral incisor (Fig. 1). Clinical tests revealed the maxillary right lateral incisor to be within normal limits to percussion and slightly tender to palpation, with a normal response to cold. The vitality of the pulp was later confirmed with a test cavity. Radiographic examination revealed a 1×2 cm radiolucency adjacent to the mesial aspect of the apex of the maxillary right lateral incisor (Fig. 2). The sinus tract was traced with a gutta-percha point to the lesion.

Radiographs revealed an enamel-lined tract, mesial to and separate from the main root canal system, that tracked to the apical radiolucency and appeared to be wide-open at the portal of exit. There was a separate root canal system distal to the dens that appeared to be closed apically. A diagnosis was made of normal pulp with chronic apical periodontitis associated with the type 3 dens invaginatus.

A treatment plan was formulated that included nonsurgical endodontic treatment of the dens tract over several appointments, including placement of a calcium hydroxide dressing. Surgical intervention was considered a strong possibility. Every effort would be made to leave the main root canal system undisturbed.

After a test cavity, which confirmed the vitality of pulp, the tooth was anesthetized, and nonsurgical endodontic treatment was initiated. All procedures were performed with the aid of a surgical operating microscope. Of particular interest was the atypical presentation of the lingual surface of the tooth. A rubber dam was placed, and access was made in the mesiolingual aspect of the tooth (Fig. 3). Upon access into the dens, there was a serosanguinous discharge, which was allowed to drain (Fig. 4). The canal was shaped initially with long tapered diamond bur to improve access to the apical defect. Working length of the dens tract was determined with the help of an apex locator (Root Zx, J Morita). The dens was debrided as well as possible with Gates Glidden drills and hand files. Because the canal was lined with enamel, methods for cleaning and shaping were not very effective. Irrigation was performed with 5.25% sodium hypochlorite, 17% EDTA, and 100% alcohol. Calcium hydroxide (Ultracal, Ultradent, UT) was placed in the dens tract between appointments (Fig. 5). The access cavity was sealed with Cavit and IRM between visits to prevent contamination of the dens canal system.

FIG 1. Sinus tract in the buccal aspect of the maxillary right lateral incisor. It was traced to the lesion.

FIG 2. Dens invaginatus lateral incisor with periapical involvement.

At the second appointment, 3 weeks later, the sinus tract was found to be healed. However, there was more serous discharge followed by bleeding through the access cavity after removal of calcium hydroxide paste. After further irrigation, more calcium

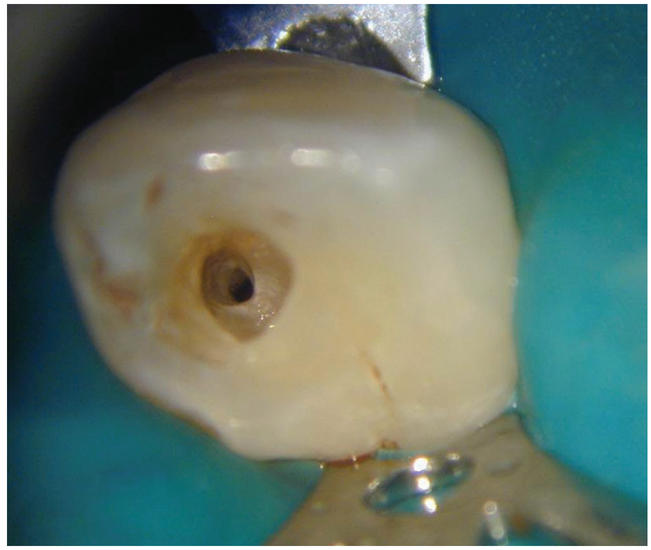

FIG 3. Initial access made in the mesiopalatal aspect of the tooth.

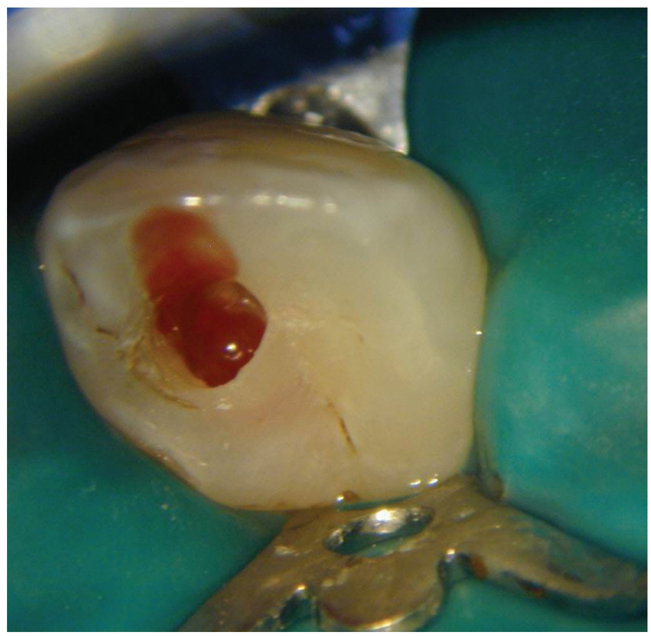

FIG 4. Drainage on access.

hydroxide was placed in the canal and the patient was asked to return 3 weeks later for completion of nonsurgical endodontic treatment followed by endodontic surgery.

At the third appointment, the calcium hydroxide was removed from the canal with irrigation, and there was more drainage. The rubber dam was removed, and a full-thickness flap was reflected to expose the lesion (Fig. 6). The window into the lesion was enlarged, and the soft tissue contents were removed (Fig. 7). Care was exercised not to impinge on the apical area where the root canal system exited. With the help of an air-driven surgical handpiece (Impact Air, Palisade Dental), the apical defect was carefully beveled to improve access to the dens. A large amount of necrotic tissue was found in the apical third of the dens tract. A custom-bent ultrasonic tip (http://eie2.com) was used with a Satelac ultrasonic unit to remove the tissue from the apical portion of the dens tract (Fig. 8). Bendable and flexible surgical mirrors (eie2.com) were

FIG 5. Calcium hydroxide in the canal as interappointment medication. Access sealed with cavit and IRM.

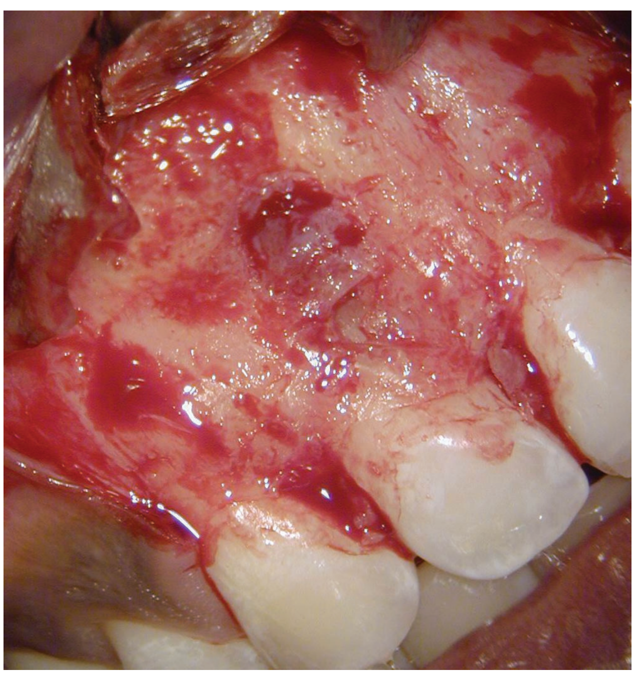

FIG 6. Full thickness flap raised. Notice the large periapical lesion.

used for clear vision into the apical defect. With a high vacuum placed at the root end, the dens canal was flushed repeatedly with saline and chlorhexidine gluconate 0.12% (Perioguard) through the

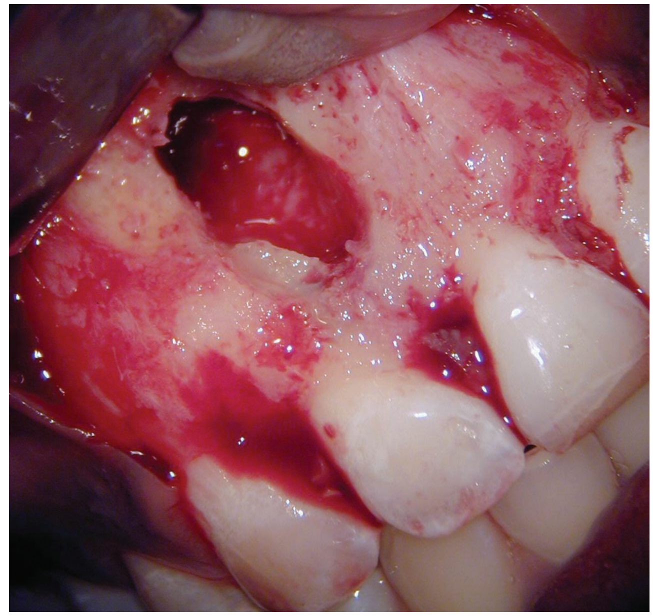

FIG 7. Lesion was curetted. Notice the extent of the bony defect with intact palatal bone.

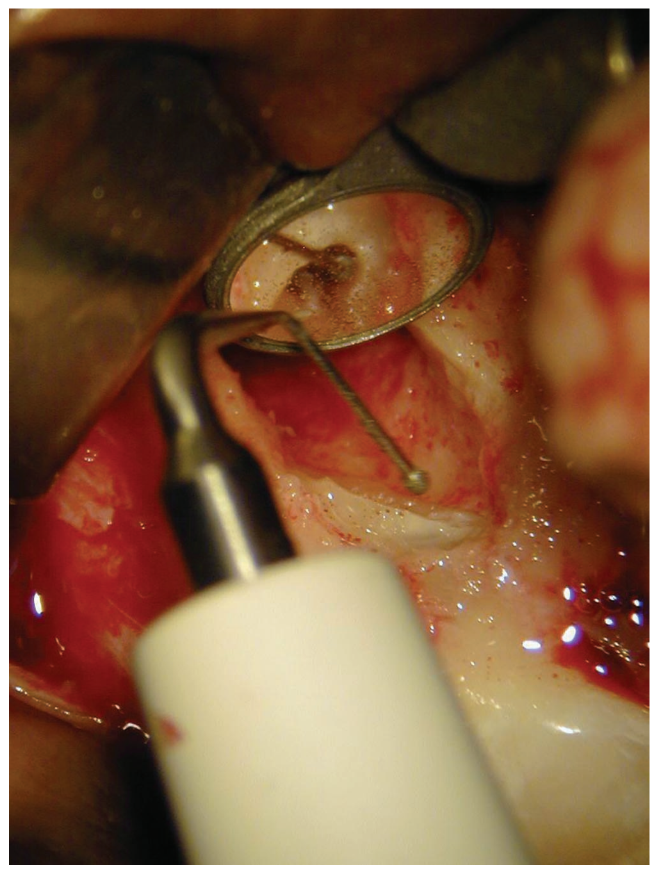

FIG 8. Custom-bent ultrasonic tip used to clean the apical defect of the root.

coronal access to clean and disinfect the canal system. Once the canal was devoid of any residual tissue, it was dried with a Stropko irrigator (Vista Dental, Racine, WI) in preparation for the root-end filling and obturation of the remainder of the dens tract (Fig. 9).

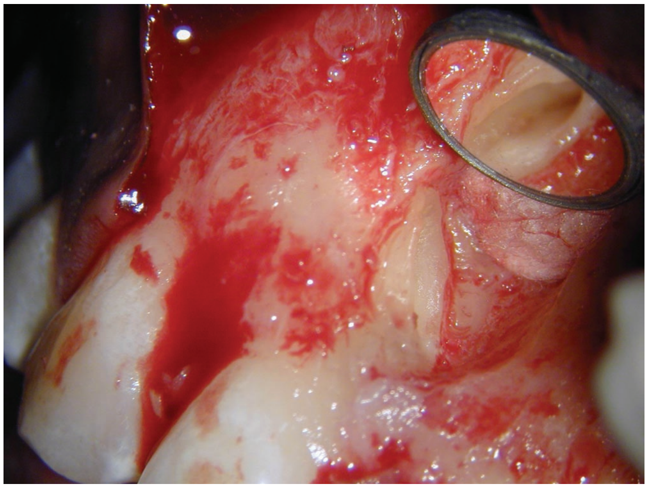

FIG 9. Retro view of the cleaned apical defect through the mirror.

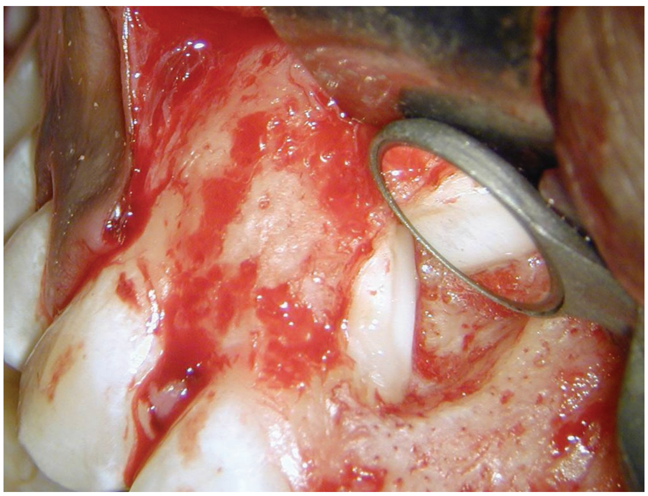

FIG 10. Root-end filling with dual cure dentin bonding agent with filler particles (Optibond).

The root end was etched with 37% phosphoric acid for 10 seconds. A coat of primer (Kerr Corp., Orange, CA) was applied for 10 seconds and air-dried for 10 seconds. A drop of dual-cure activator was mixed with one unit dose of dual cure paste (Optibond, Kerr Corp.), and the mix was teased into the apical defect and light-polymerized (Fig. 10). Because of its dual-cure nature, the composite in the deeper parts of the canal will polymerize even if light penetration is insufficient. A check radiograph verified the flow and dense fill of the root-end filling (Fig. 11). Because the lesion was quite large, medical-grade calcium sulfate was mixed with saline to a thick slurry and placed into the crypt to aid bone healing. The flap was repositioned and secured with 6-0 Tevdek sutures.

The rubber dam was placed back on the tooth, and the remainder of the dens tract was filled orthograde with warm gutta-percha using an Obtura Gun (ObturaII, Fenton, MO) and Kerr pulp canal sealer. The access opening was sealed with a light-cured composite, and a postoperative radiograph was taken (Fig. 12).

The patient returned in 48 hours for suture removal and was seen at 1-month, 2-month, and 4-month recall periods. Complete resolution of the sinus tract was observed, and the tooth was within normal limits to percussion and palpation at each recall appointment. Radiographs showed rapid healing of the bony defect (Figs. 13, 14, 15). At each appointment, the tooth responded normally to cold.

FIG 11. Check radiograph to confirm proper flow and fill of Optibond in the root-end defect.

DISCUSSION

Root canal treatment of teeth with dens invaginatus can be difficult because of the unpredictable shape of the internal anatomy and the fact that the dens tract is lined with enamel (1). The large and irregular volume of the root canal system makes proper shaping and cleaning difficult. Calcium hydroxide is helpful as an interappointment dressing because of its antimicrobial and tissue-dissolving properties (7). Several changes are sometimes necessary to get adequate tissue debridement. Ferguson et al. (8) also described the use of calcium hydroxide in teeth with dens tracts for apexification. Irrigation supported by ultrasonics has been recommended as another method to enhance disinfection (9).

Khabbaz et al. (10) described treatment of the dens tract as a separate canal.

A warm gutta-percha obturation technique as recommended by Rottstein et al. (11) was used in this case as an effective method to fill the irregular root canal space.

Nonsurgical treatment sometimes fails because it is difficult to gain access to all parts of the root canal system (11). In many teeth with dens tracts, such as this one, surgery may become necessary for a successful outcome.

FIG 12. Immediate postoperative radiograph showing obturation of the entire dens canal system. Notice radiopaque calcium sulfate in the bony defect to promote bone regeneration.

FIG 13. One-month recall showing healing in progress with the resorption of caso4.

In some cases, the anomalous structure of dens invaginatus is internal and a separate entity from the rest of the tooth. In these instances, the complete removal of the central-anomalous structure and total removal of pulp tissue can be accomplished with the use of ultrasonics and a surgical operating microscope (12).

Dual-cure Optibond is a dentin bonding agent that contains filler particles. It is, essentially, a lightly filled flowable composite. It was chosen in this case as the root-end filling material for its easy handling characteristics and excellent seal. It also strengthens the thin walls of the root. It can be used only in the presence of excellent hemostasis, however. Andreasen et al. (13) have shown periodontal tissue regeneration including cementogenesis adjacent to retrograde composite fillings.

Calcium sulfate can be used to aid in hemostasis and crypt control during surgery. It also acts as a soft tissue barrier (14) and has been shown to aid in rapid bone regeneration (15). It is absorbed by the body within a few weeks after it is placed in the crypt. In this case, it was used to aid in complete bone regeneration and to prevent scar formation, because the lesion was quite big.

The present case discusses the application of these biological and clinical principles in the treatment of a challenging dens invaginatus case. Nonsurgical and surgical treatment was performed to achieve a successful outcome. Long-term recalls are planned to ensure the vitality and functionality of the tooth.

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FIG 14. Two months postoperative showing progressive healing.

FIG 15. Four-month recall showing excellent healing.