Type 2 *Dens Invaginatus* in a Maxillary Lateral Incisor: A Case Report of a Conventional Endodontic Treatment

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Dens invaginatus is a rare malformation of the teeth resulting from the invagination of the tooth crown before biological mineralization occurs. In most cases, the thin or incomplete enamel lining of the invagination cannot prevent the entry of bacteria into the pulp, which leads to pulp necrosis with an eventual periapical inflammatory response. The treatment options include preventive sealing or filling of the invagination, root canal treatment, endodontic apical surgery and extraction. The root canal treatment of such teeth is often complicated because of their anatomical complexity. This case describes a successful non-surgical endodontic treatment of a maxillary lateral incisor with type 2 dens invaginatus with a large periradicular lesion. At follow-up examinations after 6 and 12-months, the tooth was asymptomatic and the healed lesion was evident radiographically.

Keywords: *calcium hydroxide, dens invaginatus, root canal treatment*
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INTRODUCTION

Dens invaginatus is a rare malformation of the teeth resulting from the invagination of the tooth crown before biological mineralization occurs.[1-3] Different classifications have been suggested.[4] The most commonly used classification was proposed by Oehlers,[5] who classified *dens invaginatus* into 3 types according to their expression.[6] In type 1, the invagination is lined by enamel and ends as a blind sac within the confines of the crown. In type 2, the enamel-lined invagination extends apically beyond the external cemento-enamel junction, ending as a blind sac and never reaching the periapical tissues. It may or may not communicate with the pulp tissue. In type 3, the invagination forms a second foramen in the apical area or ends somewhere in the periodontal ligament. It does not communicate with the pulp. Enamel can be found throughout the invagination, and sometimes cementum may be observed in the invagination.[1]

Radiographically, the roots present smaller dimensions with the presence of a radiopaque formation with a density similar to that of enamel, which is invaginated from the cusp through variable extensions into the root. This invagination varies in shape and size and may present a loop-like or pear-shaped configuration or a slightly radiolucent structure, or even more extensive and bizarre shapes, simulating a "tooth within a tooth."[7] In most cases, *dens invaginatus* is detected by chance on the radiograph.[4]

Clinically, unusual crown morphology or a deep foramen *coecum* may be important hints of its existence. However, these patients often seek out a dentist because of acute pain.[4] The crown of an affected tooth may appear normal or display alterations in size and shape.[3] The finding most often associated with *dens invaginatus* is early pulpal involvement when channels extend from the invagination into the pulp. Because the invagination forms a space conducive to dental caries, bacteria and their by-products gain access to the dental pulp via the channels, resulting in pulp pathosis.[8-10]

Several treatment modalities have been described for these teeth, all related to the degree of anatomical complexity.[11] The treatment options include preventive sealing or filling of the invagination, root canal treatment, endodontic apical surgery, intentional replantation and extraction.[1] Root canal treatment of such teeth is often complicated by the unusual forms and location of invaginated and pulpal spaces that complicate a thorough debridement.[6]

This case describes a successful non-surgical endodontic treatment of a maxillary lateral incisor with type 2 *dens invaginatus* with a large periradicular lesion.

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CASE REPORT

A 13-year-old male patient was referred to the Federal University of Pernambuco, Stomatology Clinic for evaluation and treatment of a sinus tract located above the maxillary left lateral incisor. The patient was referred for treatment to the Federal University of Pernambuco, Endodontic Specialty Clinic. During clinical examination, a sinus tract was observed measuring approximately 1.5 x 1.0 cm over the maxillary left lateral incisor and tender to percussion and palpation (Fig. 1A). Both, thermal and pulp tests depicted a non-vital pulp. The crown was of normal appearance, similar to the crown of the right lateral incisor (Fig. 1B). All maxillary anterior teeth responded normally to pulpal sensitivity testing and percussion, except for the maxillary left lateral incisor. The patient had no significant medical history. Based on the clinical and radiographic examination, pulp necrosis and chronic apical periodontitis, an Oehlers type 2 invagination was diagnosed (Fig. 2A). Following parental consent, the tooth was anesthetized with 2% mepivacaine hydrochloride 1:100,000 epinephrine and isolated using a rubber dam; access preparation was completed, the pulp chamber was irrigated with 1% sodium hypochlorite (Farmácia Escola Carlos Dumont de Andrade, Pernambuco, Brazil) and dried with a sterile cotton pellet. An invaginated mass of hard tissue occupied almost the entire pulpal space. Three canal orifices (mesial, central and distal) were located. The pulp chamber was irrigated with 1% sodium hypochlorite, and coronal flaring was performed with an orifice opener (Dentsply-Maillefer, Ballaigues, Switzerland). The Double-Flared Instrumentation Technique was selected[12] using hand NiTi files (NitiFlex, Dentsply-Maillefer, Ballaigues, Switzerland) under constant irrigation. The canal was explored with the #10 C+ file (Dentsply-Maillefer, Ballaigues, Switzerland) 5 mm short of the radiographic apex, where the instrument separated into the distal canal (Fig. 2B); the separated file was removed during the biomechanical preparation with a #15 C+ file. The working length was determined radiographically, measuring 14 mm for the mesial, 18 mm for the central and 17 mm for the distal root canals. The root canals were enlarged to master file sizes of #35, #50 and #50, respectively, for the mesial, central and distal root canals and dried with sterile paper points (Dentsply-Maillefer, Petrópolis, Brazil). A calcium hydroxide paste (Calen, SS White, Rio de Janeiro, Brazil) was applied, and access to the cavity was temporarily sealed with Cavit. The patient returned 1 week later and the sinus tract had healed. The calcium hydroxide paste was removed, the root canals were filled using cold lateral condensation with AH Plus Sealer (Dentsply/De Trey, Konstanz, Germany) and the pulp chamber was cleaned with cotton balls soaked in orange oil (Phormula Ativa, Pernambuco, Brazil). A new radiograph showed that the root filling was complete (Fig. 3A). Finally, the crown was permanently restored with light-cured composite resin (TPH Spectrum, Dentsply, Rio de Janeiro, Brazil). At the 6 and 12-month follow-up (Fig. 3B), the tooth was asymptomatic and there was no radiolucency around the apical region.

DISCUSSION

The incidence of *dens invaginatus* is reported to be 0.25% to 10% of the cases examined and the most frequently affected tooth is the maxillary lateral incisor[2-4,6-9,11,13] Other teeth that develop this anomaly are the maxillary central incisors, premolars, canines and molars.[13] However, *dens invaginatus* is rarely seen in the mandibular permanent or any of the primary teeth.[13,14] Unilateral expression is common, but bilateral cases are also found.[1,15] In addition, *dens invaginatus* may appear together with other abnormalities, such as taurodontism, microdontia, gemination and dentinogenesis imperfecta.[16,17] The case presented here was diagnosed as an Oehlers type 2 invagination that invaded the root without extending into the periapical area. There was communication between the invagination and the pulp.

Other names for this type of malformation are dens in

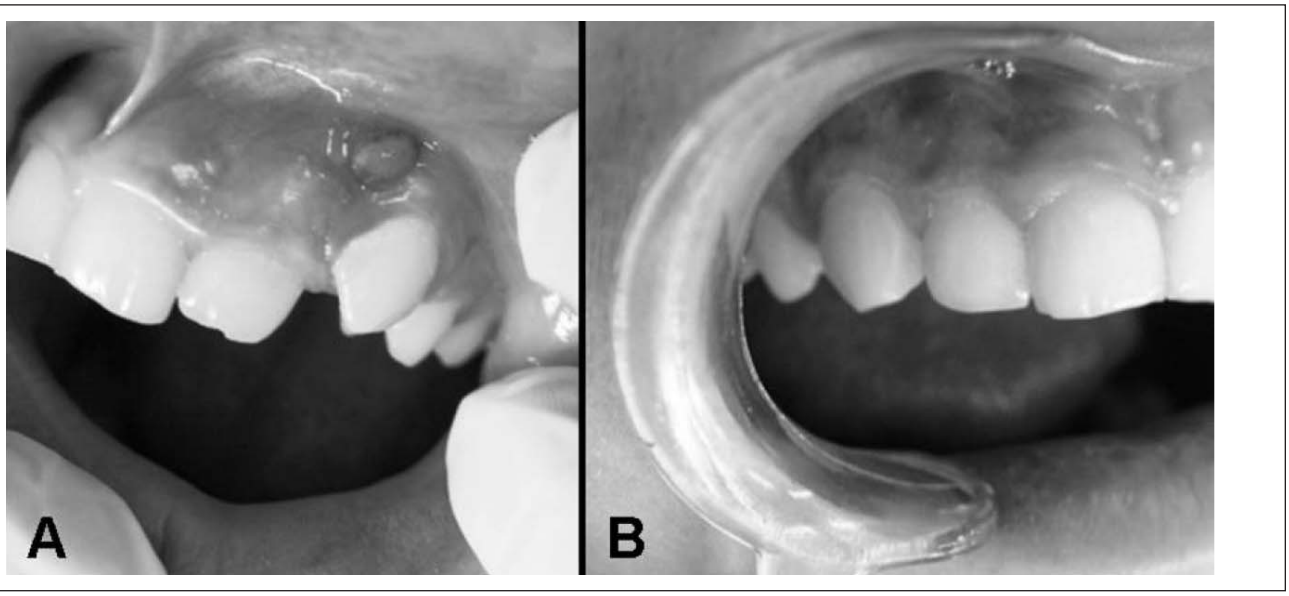

Figure 1. A: Sinus tract stoma and the clinical appearance of the maxillary left lateral incisor. B: Clinical appearance of the right lateral incisor.

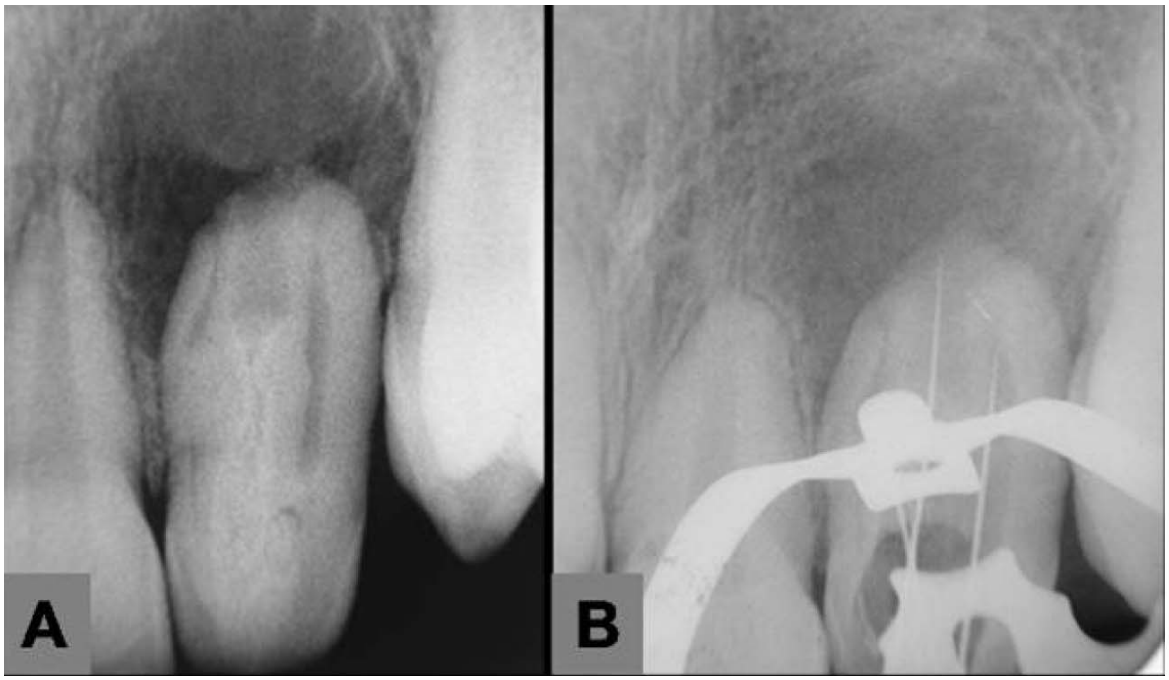

Figure 2. A: Preoperative radiograph of the maxillary left lateral incisor showing a type 2 dens invaginatus with periapical involvement. **B:** Separated #10 file in the distal root canal.

dente, invaginated odontoma, dilated gestant odontoma, dilate composite odontoma, tooth inclusion, dentoid *in dente*[11] and *dens* telescopes,[16] and the differential diagnosis includes root invagination, double root, gemination tooth or odontoma. The etiology of this malformation remains unclear. Kronfeld[18] proposed that *dens invaginatus* is caused by a focal failure of growth of the internal enamel epithelium. Oehlers[5] proposed that distortion of the enamel organ occurs during tooth development. Other theories include infection, trauma and genetics as possible contributing factors.[16,19]

Root canal treatment of teeth with *dens invaginatus* can

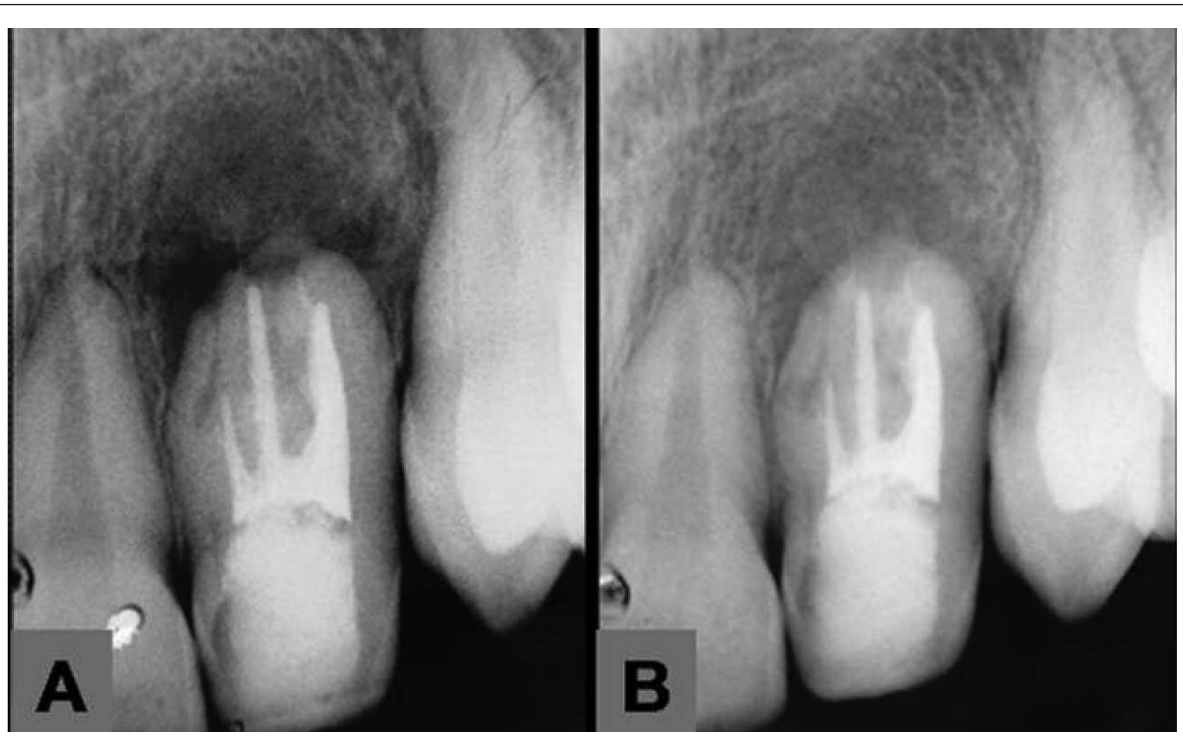

Figure 3. A: Postoperative radiograph of the maxillary left lateral incisor. **B:** Twelve-month recall radiograph of the tooth showing complete bone healing and no radiolucency around the apical region.

be difficult because of the unpredictable shape of the internal anatomy and the lining with enamel.[15,19] This presents a dilemma with regard to the treatment of the *dens invaginatus* using conventional root canal therapy. For these reasons, endodontists should master a variety of techniques and materials and select the most appropriate for removal of necrotic tissue and bacteria.

In the 1970s Grossman[20] and Creaven[21] proposed root canal treatment of the invagination instead of extraction, and reporting that with root canal therapy or apical surgery, cases of *dens invaginatus* may have a favorable result. Surgery is another treatment of choice in cases where conventional endodontic treatment is likely to fail because of the complexity of the root canal system. However, as the present case demonstrates, non-surgical root canal treatment of invaginated teeth with periapical pathosis is preferable and often has a favorable prognosis.[11]

In the present case, after biomechanical preparation with hand instruments and copious irrigation with 1% sodium hypochlorite, calcium hydroxide paste was chosen for the intracanal dressing; calcium hydroxide is helpful as an interappointment dressing because of its antimicrobial and tissue-dissolving properties, thereby improving long-term success.[4,19] In addition, the use of an intracanal medication may be needed to assist in the disinfection of root canal systems that are not fully accessible.[9]

The requirement for a successful endodontic treatment is the complete removal of irritants from the root canal system followed by a biocompatible filling material. Thermoplastic methods[4] and warm gutta-percha obturation techniques[19,22] seem preferable to other techniques, although some authors have reported success with lateral condensation,[6,23] used in this case as an effective method for filling the irregular root canal space. AH Plus is an epoxyamine-based resin and was chosen in this case as the root-end filling material for its favorable properties, such as excellent sealing capacity, lower leakage, bond strength, adequate radiopacity and bonding.[24-26]

CONCLUSION

This case illustrates that even in a tooth with severe type 2 *dens invaginatus* and an associated large periradicular lesion, careful and long-term calcium hydroxide treatment, followed by conventional endodontic treatment without surgical intervention, can result in satisfactory periradicular healing.

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