

## Case Report Article

# Successful non-surgical endodontic management of type III dens invaginatus by using cone-beam computed tomography: a case report

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## Abstract

**Introduction:** Dens invaginatus (DI) is a rare malformation of a tooth caused by the invagination of tooth crown before biological mineralization occurs. In DI type III invagination extends beyond the cementum-enamel junction, with the second foramen extending into the periapical tissues or into the periapical area. DI type III may pose real challenges for the clinician, especially when endodontic treatment is required. **Objective:** The present case report describes the successful non-surgical endodontic management of a tooth with DI type III with the aid of cone-beam computed tomography (CBCT). **Case report:** A 20-year-old male patient was referred for endodontic evaluation and treatment of the left maxillary lateral incisor (tooth #22), which presented a darker and unusual crown shape. Periapical radiography and CBCT scans revealed the presence of a type III DI, and a larger periapical lesion associated with external root resorption and discontinuous buccal cortical plate. **Results:** The diagnosis of Oehlers type III DI with asymptomatic apical periodontitis was established, and non-surgical endodontic treatment was initiated. After 5 months, a decrease in the periapical lesion and arrest of external resorption was detected. The root canals were then

filled, and the tooth restored. At the 3-years follow-up, clinical and imaging assessments revealed successful outcome of the treatment. **Conclusion:** CBCT is an inestimable tool for non-surgical endodontic management of teeth with complex internal anatomy, such as DI type III with associated large periapical lesion.

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## Introduction

Dens invaginatus (DI) or dens in dente is a developmental tooth anomaly that results from an invagination of the enamel organ into dental papilla prior to calcification of the dental tissues [8, 10]. Several theories have been proposed to explain its formation. These include pressure growth of the dental arch, focal failure of development of the internal enamel epithelium, a rapid and aggressive proliferation of part of the internal enamel epithelium, distortion of the enamel organ, a fusion of two dental germs and trauma [3, 17].

The reported prevalence of DI ranges from 0.04% to 12% [2, 8], with the maxillary lateral incisor the most frequently involved tooth [2, 8, 9, 15]. Numerous attempts have been made to classify the degree of malformation associated with the affected tooth [2, 8]. The most widely used classification system was proposed by Oehlers, which categorizes invaginations into 3 classes as determined by how far they extend radiographically from the crown into the root [10]. Type I consists of an invagination that is confined to the tooth's crown and does not extend beyond the level of the cementum-enamel junction. In type II, the invagination extends into the root, ending as a blind sac, with no communication with the periodontal ligament, but it may have connection with the pulp. In type III, the invaginations extend through the root and communicates laterally (IIIa) or apically (IIIb) with the periodontal ligament [10].

Although DI can be detected by routine periapical radiograph [14], this image method may yield insufficient diagnostic information [15], hindering the effective management of the invaginated tooth [1, 8]. In cases where DI is identified or suspected, cone-beam computed tomography (CBCT) has been advised, as it provides not only information about the exact anatomy of the root canal system, but also the size of the invagination, its depth, and its relationship with the main canal [15, 16]. In possession of these information, would it be possible to determine a more predictable treatment plan. Since the internal morphology of a DI can varies considerably and the management of this condition is dictated by

the anatomic complexity of each individual case [2, 8], more evidence is needed.

The present case report aimed to describe the successful non-surgical endodontic treatment of a maxillary lateral incisor with type III DI and large periapical lesion with the aid of CBCT.

## Case report

A 20-year-old male patient with no contributory medical history was referred for endodontic evaluation and treatment of the left maxillary lateral incisor (tooth #22). The referral had been made by his general dentist after a periapical radiography have revealed the presence of a DI with signs of a type III invagination and a large periapical lesion. The patient reported having experienced pain, swelling and pus discharge around the tooth #22 three weeks before the referral, but at the time of the examination, he had no symptoms. His general dentist had prescribed antibiotic (amoxicillin 500 mg) and anti-inflammatory (nimesulide 100 mg) medications. A prior evaluation by another endodontist had prompted the recommendation of tooth #22 extraction.

Extraoral examinations revealed no abnormalities. On intraoral analysis, it was observed that the tooth #22 had unusual crown shape, and that it was darker in color than the adjacent teeth (figure 1 - A and B). The tooth #22 presented no caries or restorations, and the periodontal probing depths were in the normal range with no mobility. Palpation and percussion tests induced no discomfort or pain. Cold test using Endo Ice (Maquira Indústria de Produtos Odontológicos S.A, Maringá, PR, Brazil) elicited no response on the tooth #22, although adjacent teeth responded normally.

To better understand the internal morphology of the tooth #22, a CBCT scan was performed. CBCT reconstructions confirmed the presence of a type III DI. In addition, a complete formed apex, and a large periapical lesion associated with external root resorption and discontinuous buccal cortical plate were observed (figure 2 - A-D). Based on clinical and imaging findings, a diagnosis of Oehlers type

III DI with asymptomatic apical periodontitis was established. After discussing with the patient, the available treatment options, their risks, benefits and challenges, an informed consent was obtained for performing non-surgical endodontic treatment of the tooth #22.

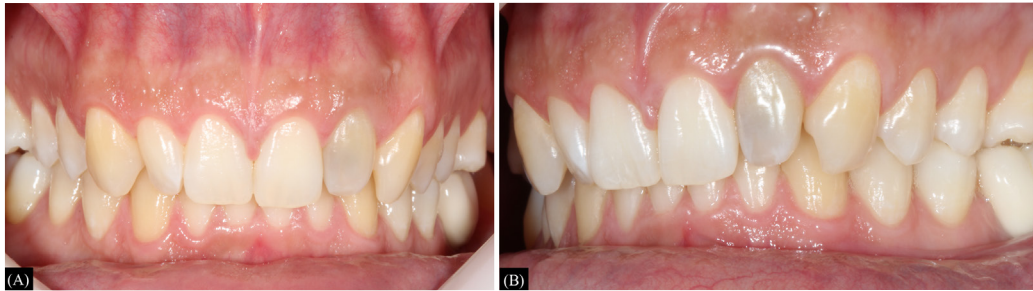


Figure 1 - Preoperative intraoral aspects of tooth #22

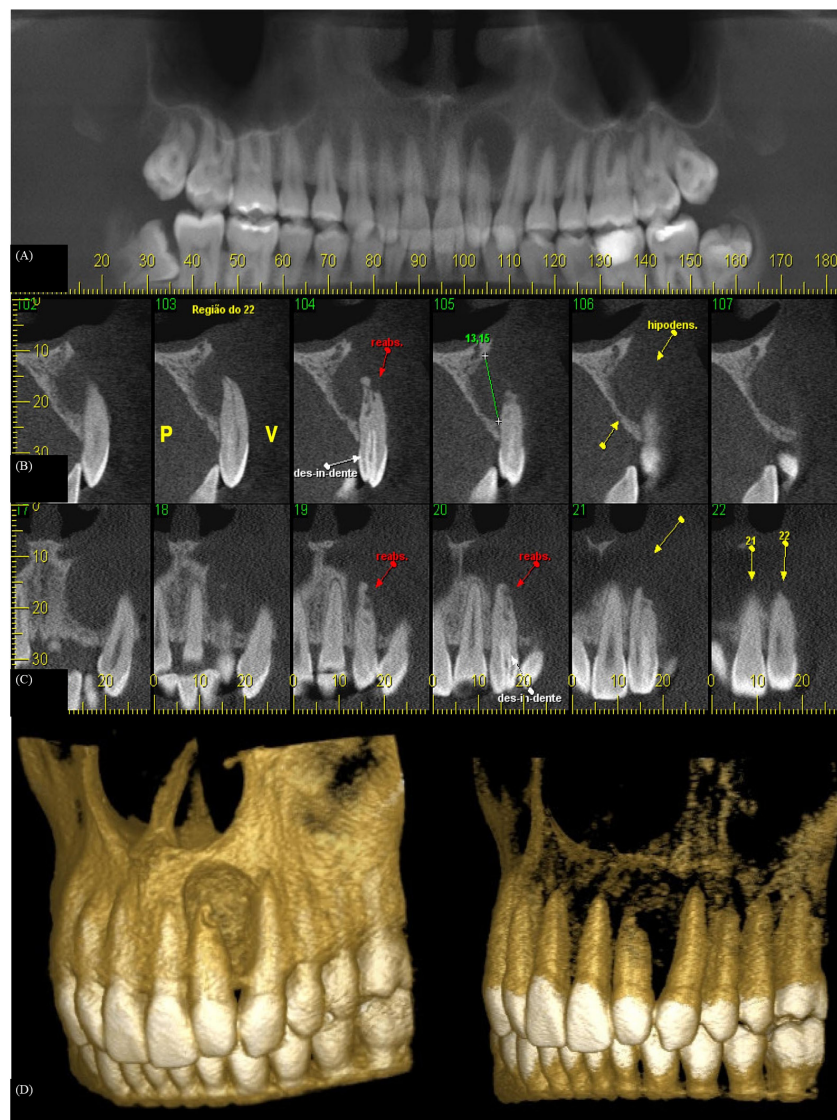


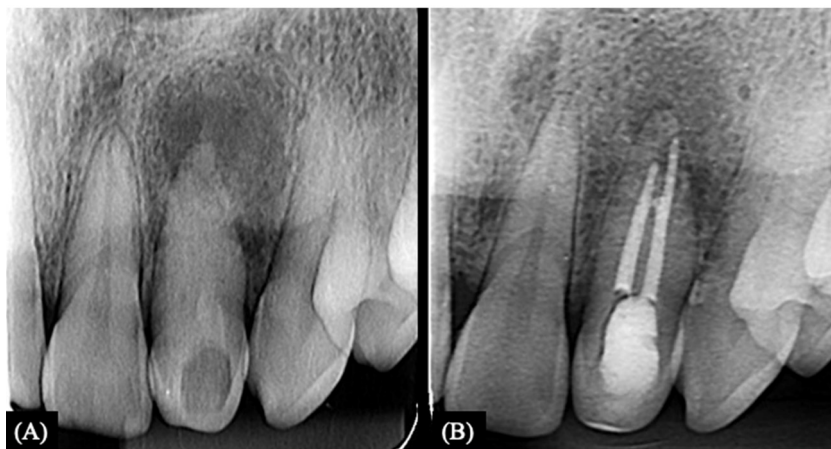
Figure 2 - CBCT reconstructions of tooth #22 showing a DI type III with large periapical lesion and external root resorption and (A-D)



In the first appointment, the area of tooth #22 was anesthetized with 2% lidocaine with 1:100.000 epinephrine (DFL Indústria e Comércio, Rio de Janeiro, RJ, Brazil) and the tooth was isolated with a rubber dam. Endodontic access was prepared with a spherical diamond #1013 bur (KG Sorensen, Barueri, SP, Brazil), and two canal orifices were identified, 1 mesial and 1 distal. A total of 2 canals were found. The 2 canals were explored with #10 and #15 K-Files (Dentsply Maillefer, Ballaigues, Switzerland). The working lengths were determined using an electronic apex locator (Propex II; Dentsply Maillefer) and confirmed subsequently with a periapical radiograph. Root canal preparations (RCP) were performed using a crown-down technique with the BioRace nickel-titanium (NiTi) rotary system (FKG Dentaire, La Chaux-de-Fonds, Switzerland). The last instrument used was BR5 (#40/0.04). The root canals were irrigated with 2.5% sodium hypochlorite (NaOCl; Fitofarma, Goiânia, GO), followed by a final flush with 17% EDTA (Biodinâmica, Ibiporã, PR, Brazil) and neutralization with 2.5% NaOCl (Fitofarma). All irrigant solution were passively activated in 3 cycles of 20 s each using an EMS PM 200 ultrasonic unit

(EMS-Electro Medical Systems, Nyon, Switzerland) and an E1 Irrisonic tip (Helse, Santa Rosa do Viterbo, Brazil). Next, the canals were dried using paper points (Dentsply Maillefer) and dressed with calcium hydroxide powder [ $\text{Ca}(\text{OH})_2$ , Biodinâmica] mixed with saline (figure 3A). The access cavity was then sealed with a glass ionomer cement (Maxxion R; FGM, Joinville, SC, Brazil). The  $\text{Ca}(\text{OH})_2$  paste was renewed every 30 days for 4 months until a decrease in the size of the periapical lesion and arrest of external root resorption was observed.

At the final appointment, 5 months after the beginning treatment, the root canals filling were performed. After rubber dam placement, access opening was obtained, and the canals were irrigated and re-prepared using the same protocol used during the first appointment. Then, the canals were dried using paper points (Dentsply Maillefer) and filled by lateral condensation of the gutta-percha (Tanari, Manaus, AM, Brazil) and Sealapex sealer (Sybron Endo, Orange, CA, USA). The access cavity was cleaned and then restored by using a composite resin (3M ESPE®, Saint Paul, Minnesota, MI, USA). A final radiograph was performed (figure 3B).

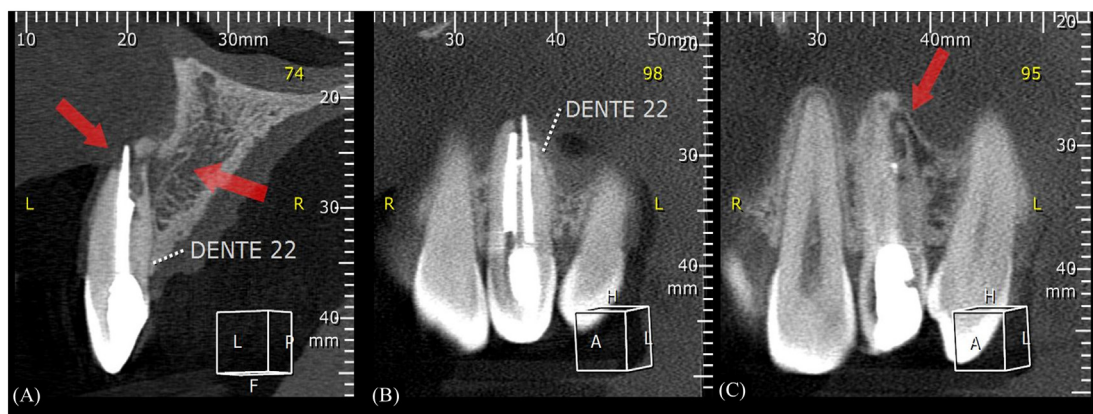


**Figure 3** - Periapical radiographs of tooth #22 after intracanal medication (A) and root canal filling (B)

Three years after the treatment, the patient returned and was asymptomatic, and although the crown of tooth #22 had been discolored, probably by the root canal sealer, the tooth was functional with normal soft tissues condition and there was no evidence of sinus tract (figure 4A). Periapical radiographic (figure 4B) and CBCT assessments revealed complete repair of the periapical lesion (figure 5 - A-C).



**Figure 4** - Intraoral aspect after 3 years of follow-up showing a tooth in function (A). Periapical radiographs of tooth #22 revealed regression of the periapical lesion (B).



**Figure 5** - Sagittal (A), and coronal (B-C) CBCT slices after 3 years showing bone neoformation and regression of the periapical lesion

## Discussion

Management of DI is challenging because of the complex root anatomy and canal morphology [11]. Endodontic treatment of teeth with DI type III generally involves complicated procedures that require accurate diagnosis and appropriate treatment planning [2, 8, 12]. This case report discusses a case in which Oehlers type III DI with 2 root canals and associated large periapical lesion was successfully treated by a non-surgical endodontic approach. Also, it emphasizes the importance of CBCT imaging as a useful aid for assisting in understanding internal morphology and in decision making.

The diagnosis of DI may depend on the clinician's knowledge and experience but is more influenced by the quality of imaging examination [2, 15, 16]. Periapical radiography plays an important role in evaluating the complex morphology of the root canal system of a DI [16]. However, it only

provides bi-dimensional (2D) representation of a three-dimensional structure (3D) [1]. 2D imaging evaluation may lead to doubtfulness about the anatomical conditions [1, 15, 16] and the lack of information about the root canal configuration can cause a disadvantage for clinicians, resulting in an unsuccessful endodontic treatment [15]. CBCT has demonstrated improved diagnostic and treatment planning capabilities for suspected cases of DI and provides greater insight into their complex radicular configuration [1, 16]. In this case, CBCT revealed the exact root canal anatomy, extent of the invagination, and size of the periapical lesion. With the use of CBCT, it was possible to determine a suitable treatment plan.

Teeth with DI have small pits with defective or even absent enamel which lead to the colonization of microorganisms and further development of dental caries and pulp and periapical diseases [2, 8, 10]. Depending on the degree of malformation and on clinical symptoms, there are different

strategies for therapy, such as preventive sealing/filling of the invagination, nonsurgical endodontic treatment, apexification or regenerative endodontic procedures, periradicular surgery, intentional reimplantation, or extraction of the tooth [2, 6, 8]. Because of the complex internal anatomy of DI type III, non-surgical endodontic treatment is difficult and usually complicated, especially with pulp necrosis and apical periodontitis [12]. Irrespective of the size of the periapical pathology, surgical procedures should be attempted only when non-surgical endodontic treatment has failed [2, 8]. Thus, non-surgical endodontic treatment was the maximum importance for this case.

To promote sanitization of an invaginated root canal, mechanical and biological principles of endodontic therapy should be followed [4]. In the present case, 2.5% NaOCl solution was used for intracanal irrigation because of its antimicrobial characteristics and tissue dissolution capacity [4, 7]. Ca(OH)<sub>2</sub> was also used, because it is most commonly used intracanal medication in cases of teeth with pulp necrosis, periapical lesions and external resorption [4, 5]. It should be pointed out that the complex root canal anatomy of DI type III may favor the permanence of inaccessible areas to both endodontic instruments and chemical solutions [2, 8]. Therefore, NaOCl was activated ultrasonically to supplement the disinfection of the root canal system [7, 13]. The 3-years imaging exams demonstrated normal periapical bone structure, which may be indicative of the success of the adopted protocol.

## Conclusion

Cone-beam computed tomography is an inestimable tool for non-surgical endodontic management of teeth with complex internal anatomy, such as DI type III with associated large periapical lesion.

## References

1. Agrawal PK, Wankhade J, Warhadpande M. A rare case of type III dens invaginatus in a mandibular second premolar and its nonsurgical endodontic management by using cone-beam computed tomography: a case report. *J Endod.* 2016;42(4):669-72.
2. Alani A, Bishop K. Dens invaginatus. Part 1: classification, prevalence and aetiology. *Int Endod J.* 2008;41(12):1123-36.
3. Cortizo PA, Almeida GM, Porto Junior AC, Mendes EB. Dens invaginatus type III: a case report. *Dental Press Endod.* 2019;9(2):91-9.
4. Estrela C, Holland R, Estrela CR, Alencar AH, Sousa-Neto MD, Pécora JD. Characterization of successful root canal treatment. *Braz Dent J.* 2014;25(1):3-11.
5. Estrela C, Holland R. Calcium hydroxide: study based on scientific evidences. *J Appl Oral Sci.* 2003;11(4):269-82.
6. Goel S, Nawal RR, Talwar S. Management of dens invaginatus type II associated with immature apex and large periradicular lesion using platelet-rich fibrin and biodentine. *J Endod.* 2017 Oct;43(10):1750-5.
7. Gu LS, Kim JR, Ling J, Choi KK, Pashley DH, Tay FR. Review of contemporary irrigant agitation techniques and devices. *J Endod.* 2009;35(6):791-804.
8. Hülsmann M. Dens invaginatus: aetiology, classification, prevalence, diagnosis, and treatment considerations. *Int Endod J.* 1997;30(2):79-90.
9. Mehta V, Raheja A, Singh RK. Management of dens in dente associated with a chronic periapical lesion. *BMJ Case Rep.* 2015;2015:bcr2015211219.
10. Oehlers FA. Dens invaginatus (dilated composite odontome). I. Variations of the invagination process and associated anterior crown forms. *Oral Surg Oral Med Oral Pathol.* 1957;10(11):1204-18.
11. Rodrigues EA, Belladonna FG, De-Deus G, Silva EJ. Endodontic management of type II dens invaginatus with open apex and large periradicular lesion using the XP-endo Finisher: a case report. *J Clin Exp Dent.* 2018;10(10):e1040-4.
12. Sharma S, Wadhawan A, Rajan K. Combined endodontic therapy and peri-radicular regenerative surgery in the treatment of dens invaginatus type III associated with apicomarginal defect. *J Conserv Dent.* 2018;21(6):696-700.

13. Sousa VC, Alencar AHG, Estrela CRA, Sousa Neto MD, Decurcio DA, Oliveira HF et al. Effectiveness of Self-Adjusting File, XP-endo Finisher, and passive ultrasonic irrigation in bacterial root canal control. *Dental Press Endod.* 2018;8(2):62-9.
14. Steffen H, Splieth C. Conventional treatment of dens invaginatus in maxillary lateral incisor with sinus tract: one year follow-up. *J Endod.* 2005;31(2):130-3.
15. Teixidó M, Abella F, Duran-Sindreu F, Moscoso S, Roig M. The use of cone-beam computed tomography in the preservation of pulp vitality in a maxillary canine with type 3 dens invaginatus and an associated periradicular lesion. *J Endod.* 2014;40(9):1501-4.
16. Vier-Pelisser FV, Pelisser A, Recuero LC, Só MV, Borba MG, Figueiredo JA. Use of cone beam computed tomography in the diagnosis, planning and follow up of a type III dens invaginatus case. *Int Endod J.* 2012;45(2):198-208.
17. Yang J, Zhao Y, Qin M, Ge L. Pulp revascularization of immature dens invaginatus with periapical periodontitis. *J Endod.* 2013;39(2):288-92.