

**Case Report**

# Conservative treatment and follow-up of type III dens invaginatus using cone beam computed tomography

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**Abstract:** Dens invaginatus is a well-recognized phenomenon, and its endodontic treatment poses a challenge, especially for peri-invagination lesions with vital pulp. Here we describe the outcome of conservative treatment and follow-up in a case of type III dens invaginatus. Cone-beam computed tomography was used for diagnosis and follow-up. Pulp vitality was preserved with endodontic treatment of only an invaginated canal. At the 24-month follow-up examination, the tooth was asymptomatic and repair of the lesion was evident radiographically. This case was managed successfully with endodontic treatment of the invagination. (*J Oral Sci* 56, 307-310, 2014)

Keywords: dens invaginatus; peri-invagination lesion; root canal treatment; cone-beam CT.

## Introduction

Dens invaginatus (DI), or dens in dente, is a well-recognized phenomenon attributed to uncoordinated growth of part of the epithelium of a tooth germ, in which the abnormal epithelium invaginates (1). In 1934, Kronfeld proposed that DI is caused by focal failure of growth of the internal enamel epithelium leading to proliferation of the surrounding normal epithelium with eventual engulf-

ment of the static area (2).

The reported incidence of DI ranges from 0.04% to 10% and most commonly affects the permanent maxillary lateral incisors (3). To characterize the degree of malformation associated with DI, the classification by Oehlers is widely used (4). Type I describes an enamel-lined invagination, confined to the coronal part of the tooth; type II represents extension of the invagination into the root, beyond the cemento-enamel junction, ending as a blind sac. Type III includes permeation of the root by the invagination to form an additional lateral or apical foramen; usually there is no communication with the pulp.

Early diagnosis and treatment of DI is important for preventing pulp infection via the invagination. The treatment options for an invaginated tooth include preventive sealing or filling of the invagination, root canal treatment, endodontic periapical surgery, intentional replantation, and extraction (5). When no communication exists between the invagination and the pulp cavity, nonsurgical endodontic treatment of the invagination as a separate entity has proved successful (6).

The present case report describes conservative endodontic treatment of DI in a maxillary left lateral incisor (tooth 22) with a vital pulp and a peri-invagination lesion. Cone-beam computed tomography (CBCT) was used for diagnosis and follow-up of DI.

## Case Report

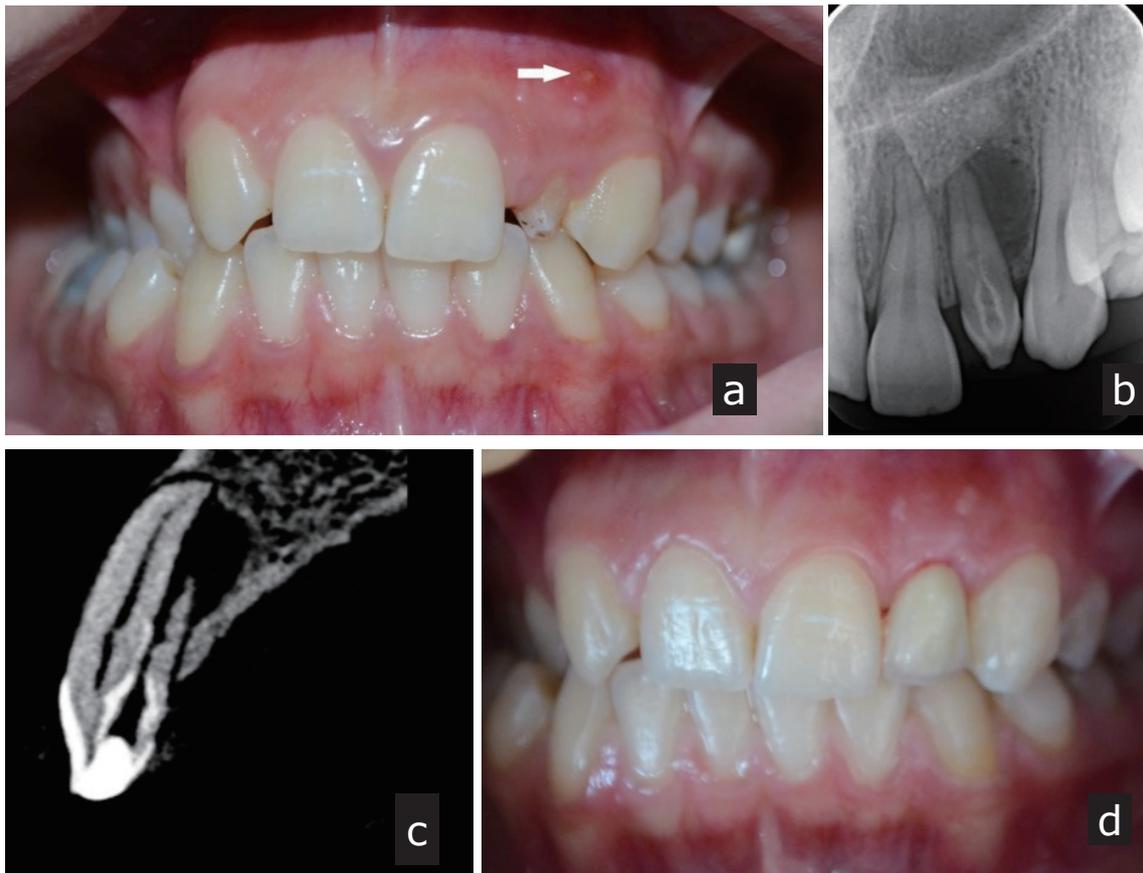
A 17-year-old female patient referred to Karadeniz Technical University, Faculty of Dentistry because of dissatisfaction with the esthetic appearance of her maxillary teeth. It was noted that there was a discharging sinus

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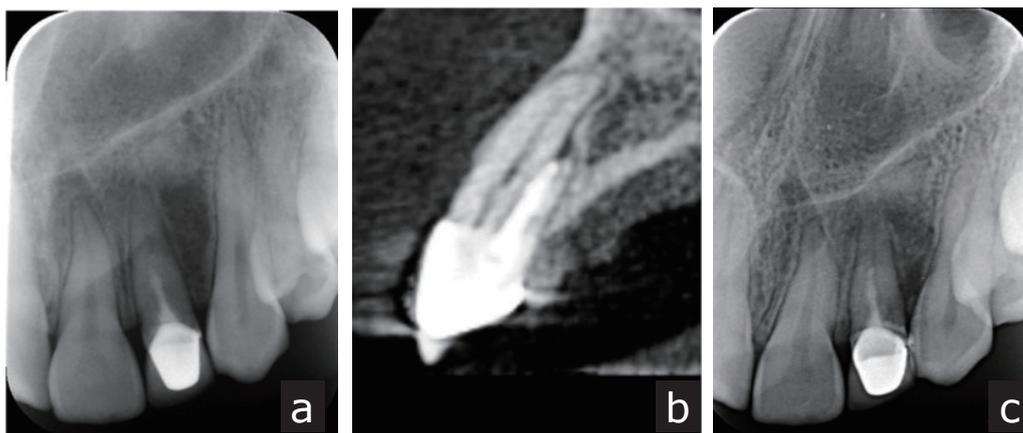


**Fig. 1** The preoperative images and restoration of the tooth. (a) Buccal clinical photograph showing that tooth 22 has a sinus tract (white arrowhead); (b) Periapical radiography showing a dens invagination and periradicular lesion; (c) CBCT image showing that tooth 22 has an Oehlers' type III dens invaginatus. The invaginated canal has a wide-open apical extent and there is no communication with the pulp; (d) Buccal clinical photograph showing a metal reinforced ceramic restoration of tooth 22.

tract between roots of teeth 22 and 23 (Fig. 1a); however, both teeth were positive for sensitivity when subjected to the cold test and electric pulp test. Upon radiographic examination, tooth 22 demonstrated dens invaginatus, and a periradicular lesion lying between the roots of teeth 22 and 23 was evident (Fig. 1b). Expansion of the periradicular lesion had resulted in some separation of the roots of these teeth. Cone-beam computed tomography (CBCT) yielded information on the extent, position, and pulpal involvement of the invagination. The invagination was positioned palatally without any intersection with the main canal and opened to the periodontium at the middle third of the root (Fig. 1c). Because the periradicular lesion was only associated with invagination, the case was diagnosed as peri-invagination periodontitis, and nonsurgical endodontic treatment was planned only for the invaginated canal.

Local infiltration anesthesia was performed for tooth 22 and the access cavity of the invagination was carefully opened, taking great care to avoid creating any

access to the main root canal. The endodontic working length was determined with a Root ZX mini apex locator (J. Morita Corp., Tokyo, Japan). The invaginated canal was instrumented gradually using H files (Mani, Tokyo, Japan) up to ISO size 50. During instrumentation, the canal was irrigated copiously with 2.5% sodium hypochlorite (NaOCl) solution after each instrument had been used. When the instrumentation had been completed, the invaginated root canal was dressed with calcium hydroxide and the access cavity was temporarily sealed with Cavit (3M ESPE US, Norristown, PA, USA) for ten days. The sinus tract was completely healed at the second visit. Temporary filling was removed and the invaginated canal was cleaned of any calcium hydroxide. After final irrigation with 2 mL of 17% EDTA, distilled water, and 2.5% NaOCl, the invaginated canal was dried with paper points and filled with a calcium silicate-based material, BioAggregate (BA, Innovative BioCeramix, Vancouver, Canada). A cotton pellet moistened with distilled water was placed in the pulp chamber, and the



**Fig. 2** The postoperative 12- and 24-month images. (a) At 12 months, periapical radiography shows the repaired periradicular lesion. (b) At 12 months, the CBCT image shows bone regeneration, and formation of an intact lamina dura surrounding the root. (c) At 24 months, periapical radiography shows the repaired lesion and a healthy lamina dura surrounding the root.

access cavity was temporarily sealed with Cavit for 24 h to allow setting of the BioAggregate. At the next appointment, the cotton pellet was removed and the access cavity was restored with a composite resin (3M ESPE, St. Paul, MN, USA). The main root canal remained untouched to preserve pulp vitality. The tooth was asymptomatic and there was a significant decrease in the size of the lesion after six months. Gingivoplasty was performed to provide an aesthetic appearance and the final restoration of the tooth was achieved with a metal reinforced ceramic crown (Fig. 1d).

At the 12- and 24-month follow-up examinations, the tooth presented no sensitivity to percussion or palpation, and the soft tissues were healthy. Radiographic examination revealed repair of the lesion (Fig. 2a and b: 12-month follow-up, Fig. 2c: 24-month follow-up). Healing was achieved without any need for further endodontic surgical intervention.

## Discussion

Teeth with DI have deep pits, which may harbor structural defects. In these defects, the enamel is often malformed or absent, and may have numerous fine canals that lead to a communication with the pulp. Thus, microorganisms and their products may easily obtain access through such communications. This continuous threat usually gives rise to infection and necrosis of the pulp, and then to periapical or periodontal abscesses (7). If the invagination extends from the crown to the periradicular tissue and has no communication with the root canal system, the pulp may remain vital (8). Despite the fact that the invagination is not a real canal, filling it is still important because the enamel and dentin of the invagination are

weak, and therefore irritants can easily penetrate to the main root canal and cause infection (5).

We have presented an interesting case of Oehlers' type III DI, associated with a sinus tract, vital pulp, and a periradicular lesion. The main root canal was assumed to contain vital healthy pulp, and CBCT evaluation did not reveal any connection between the invagination and the root canal. Maintaining the vitality of such a tooth allows the root to continue to mature while making the tooth less prone to fracture (1). Several papers have reported that the pulp in the main canal remained healthy with successful non-surgical endodontic treatment of the necrotic invaginated area (1,6,9,10). However, only two of those studies used CBCT for diagnosis and follow-up (9,10). Currently, advanced radiographic techniques with CBCT imaging may aid the diagnosis as well as the management plan and follow-up of teeth with this dental developmental anomaly (10). Before taking CBCT, a thorough consideration of risk versus benefit should be considered, especially in young patients. In the present case, conventional periapical radiographs were insufficient for diagnosing the type and pulpal relation of DI. Use of CBCT allowed the invagination to be recognized as type III. Pulp vitality was preserved with endodontic treatment of only the invaginated canal. The 12-month follow-up examination using CBCT and radiographs at 12-24 months revealed a thoroughly healed lesion and a healthy lamina dura surrounding the root.

In the present case, complete healing of a large peri-invagination lesion was achieved by nonsurgical endodontic treatment of only the invaginated canal. The main root canal remained untouched and tooth vitality was preserved. The use of CBCT for diagnosis and

follow-up provided an effective alternative to the use of conventional 2D radiography.

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