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CASE REPORT

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Endodontic management of type IIIb dens invaginatus in central incisor: A case report

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Key Clinical Message

We described a type IIIb dens invaginatus, its root canal treatment, and results on 3- and 12-month visits. Despite its significant challenges, proper endodontic therapy in such cases can cause positive prognosis and successful outcome.

KEYWORDS

cone-beam computed tomographic imaging, dens in dente, dens invaginatus, root canal therapy

1 | INTRODUCTION

Dens invaginatus (DI) also known as dens in dente, invaginated odontoma, dilated composite odontoma, dentoid in dente,[1] and telescopic tooth[2] results from infolding of the enamel organ into the dental papilla before tooth calcification.[3] The invagination may be limited to the pulp chamber or extended to the root and even the apex.[1] The prevalence of this developmental anomaly ranges 0.3%–10%.[4] DI affects any primary or permanent tooth,[5] with maxillary lateral incisors being the most commonly affected.[2] The involvement of maxillary central incisors has been reported,[2] and it may rarely occur in canines and posterior teeth.[4] DI may occur simultaneously with supernumerary teeth, but this is an uncommon phenomenon.[4] Although environmental and genetic etiological factors have been reported, the etiology of DI remains unclear.[4] Oehlers[5] categorized DI into three types based on apical extension and radiographic features[6] which is the most commonly used.[3] Type I DI is limited to the crown,[1] type II involves an invagination that extends beyond the cementoenamel junction to form a blind sac through the root, with or without communication with the dental pulp,[3] and type III is characterized by an enamel-lined infolding that penetrates through the root, opening an independent lateral (also called type IIIa)[6] or apical (also named type IIIb)[6] foramen with no pulpal communication.[3]

The clinical significance of DI lies in the increased risk of pulpal and periodontal diseases associated with the progression of microorganisms and their products through the coronal aspect of the invagination.[5] Although two-dimensional radiographs are commonly used to diagnose DI,[4] the management of severe types requires three-dimensional radiographic imaging, like cone-beam computed tomography (CBCT).[7] Management approaches vary for different types of DI, including restorative management, non-surgical root canal therapy, surgical treatment, intentional replacement, or extraction.[8]

This case report presents the management of type IIIb DI in the maxillary central incisor, along with impacted supernumerary tooth.

2 | CASE PRESENTATION

An 18-year-old Iranian male patient was referred with the chief complaint of anterior tooth shape correction. Medical history showed no evidence of systemic disease, medication, or allergic reactions. The patient fell into the ASA1 group, with no evidence of hereditary dental

anomalies and no history of dental trauma, sinus tract or swelling. No pain was reported associated with the affected tooth, and oral hygiene was fair.

Objective findings revealed normal extra oral exam, normal facial appearance, conical shaped right maxillary central incisor, and periodontium probing within the normal limit.

The clinical evaluation (Table 1) confirmed normal response of the right maxillary central incisor to percussion and palpation test with no response to cold, heat, and electric pulp tests.

Periapical radiographic findings revealed periapical radiolucency with impacted supernumerary tooth in the fully developed right maxillary central incisor (dens invagination) (Figure 1). CBCT was prescribed for treatment planning (Figure 2).

Based on the medical and dental history provided, radiographic evaluation, objective findings, and clinical evidences, the diagnosis of type IIIb dens invagination with chronic apical periodontitis and necrotic pulp of the right maxillary central incisor was made.

The recommended treatment plan comprises of non-surgical root canal treatment, follow-up, and possible surgical intervention in the future. Additionally, an alternative treatment plan was explained, which includes orthodontic replacement of the supernumerary tooth or extraction and replacement using a fixed prosthesis or implant.

After consultation with the senior orthodontist, the extraction of the supernumerary tooth was suggested, taking into account its shape and position.

The treatment procedure for the right maxillary central incisor was carried out. Four recall visits scheduled within 12 months.

During the first session, local anesthesia was administered using 2% lidocaine with 1/100,000 epinephrine (Persocaine-E; Darou Pakhsh). Access cavity preparation and tooth isolation using rubber dam were carried out. The mesial canal aspect was accessed by troughing the mesial part of the root with a muller bur. Working lengths were determined using an electronic apex locator and were confirmed radiographically. Mesial and distal part of the C-shaped root canal were prepared with hand K files (Mani) up to #40, together with rotary files up to F3 (denco blue; China) while passively ultrasonically irrigating with 5/25% sodium hypochlorite (NaOCl). A paste of creamy calcium hydroxide (Golchai) was placed in the canals using a lentulo spiral (Mani) for 10 days, and access cavity was sealed with temporary restoration.

At the second session, the right maxillary central incisor was asymptomatic and no pain was reported. Local anesthesia with lidocaine 2% and epinephrine 1/100,000 (Persocaine-E; Darou Pakhsh) was administered, followed by removal of the temporary filling and isolation using a rubber dam. The intracanal medicament was removed by copious irrigation with NaOCl combined with hand instrumentation, and a final rinse with ethylenediaminetetraacetic acid (EDTA) (EDTA; Morvabon) was performed to eliminate the smear layer. NaOCl was not used after EDTA due to the controversies about marked

FIGURE 1 Periapical radiography. Periapical radiolucency of the fully developed right maxillary central incisor and impacted supernumerary tooth are visible.

TABLE 1 Clinical evaluation of right maxillary central incisor and three other teeth as control.

Tooth number	Cold	Heat	Electric pulp test	Percussion	Palpation	Mobility
Right maxillary central incisor	–	–	–	Normal	Normal	WNL
Right maxillary lateral incisor	+ (5 s)	+ (4 s)	4	Normal	Normal	WNL
Left maxillary central incisor	+ (3 s)	+ (7 s)	4	Normal	Normal	WNL
Left maxillary lateral incisor	+ (4 s)	+ (4 s)	3	Normal	Normal	WNL

Abbreviations: s, second; WNL, within normal limit.

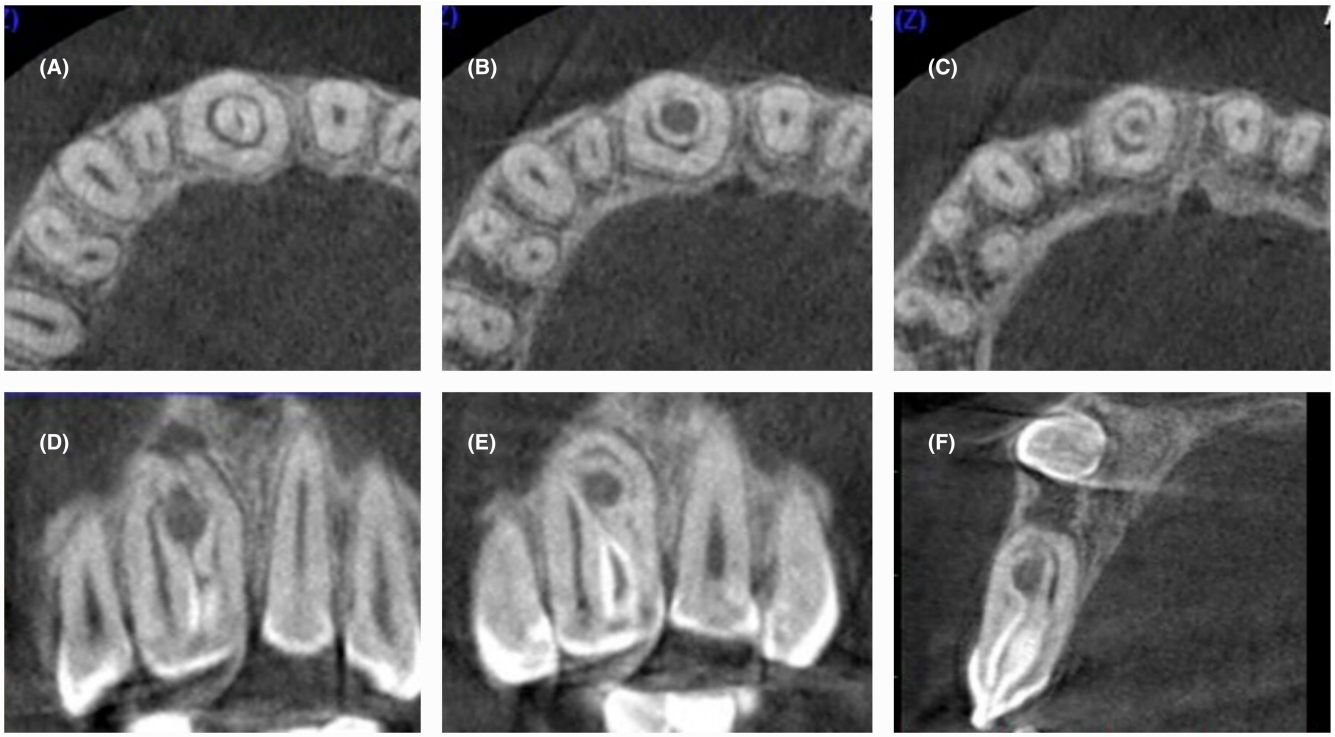

FIGURE 2 CBCT images revealed type IIIb DI and supernumerary impacted tooth. (A) Coronal region in axial view. (B) Medial region in axial view. (C) Apical region in axial view. (D) and (E) Coronal view. (F) Sagittal view.

erosion of root canal dentin following the use of this sequence of irrigation solutions.[9,10] The canal was then filled using mineral trioxide aggregates (MTA) (MTA Angelus), gutta-percha and sealer (AH-26; Dentsply Sirona). MTA was used as a plug at the coronal aspect of the invagination space to seal it and at the apex of the distal portion of the canal. This was due to the large apical diameter of the canal, which was larger than #70. The other parts of the C-shaped canal were filled with gutta-percha and sealer using the warm vertical obturating technique. The invagination space was not rinsed or filled with bio-ceramic material as no communication with the main canal was observed while scrolling through the axial view of the CBCT from coronal to apical. The healing process was evaluated during follow-up visits to determine whether to fill the invagination space. The access cavity was sealed with resin-modified glass ionomer (RMGI) (GC Fuji II LC).

Recall visits were scheduled to monitor the healing process. The 3- and 12-month follow-up evaluations showed that the right maxillary central incisor was asymptomatic, and the periapical lesion had healed. A fiber post was inserted into the mesial aspect of the canal, and the tooth was permanently restored with a resin composite filling material (GRADIA; GC). Radiographies are visible in Figures 3–7. The supernumerary tooth was extracted 3 months after the nonsurgical treatment phase of the right maxillary central incisor.

3 | DISCUSSION

DI is a developmental anomaly with the highest prevalence affecting maxillary lateral incisors.[8] However, canines, premolars, molars, and maxillary central incisors have also been reported to be affected.[8] This malformation is classified into three groups,[6] with type III being more complicated than the others.[11] A unique treatment plan is necessary for each type of dens invagination.[1] Despite only uncommon communication with the pulp occurring in type III,[11] pulpal disease or a periapical lesion has been reported in many cases.[4] Thus, three-dimensional radiography is essential for selecting the best treatment plan.[4]

In this case, type IIIb dens invaginatus with necrotic pulp and a periapical lesion was diagnosed in the right maxillary central incisor with a C-shaped canal using CBCT.

Nonsurgical root canal therapy is the first-line clinical management for necrotic teeth affected with DI.[2] Due to the complexity and variations in root canal morphology, including unreachable fines and intracanal communications, complex endodontic considerations are necessary for DI cases, and proper chemical and mechanical procedures for cleaning, shaping, and obturation are mandatory.[1] Therefore, the clinician should be well-informed about different techniques and materials.[5] Although the effect of mechanical and chemical root canal preparation on reducing the number of microbial organisms is significant, the

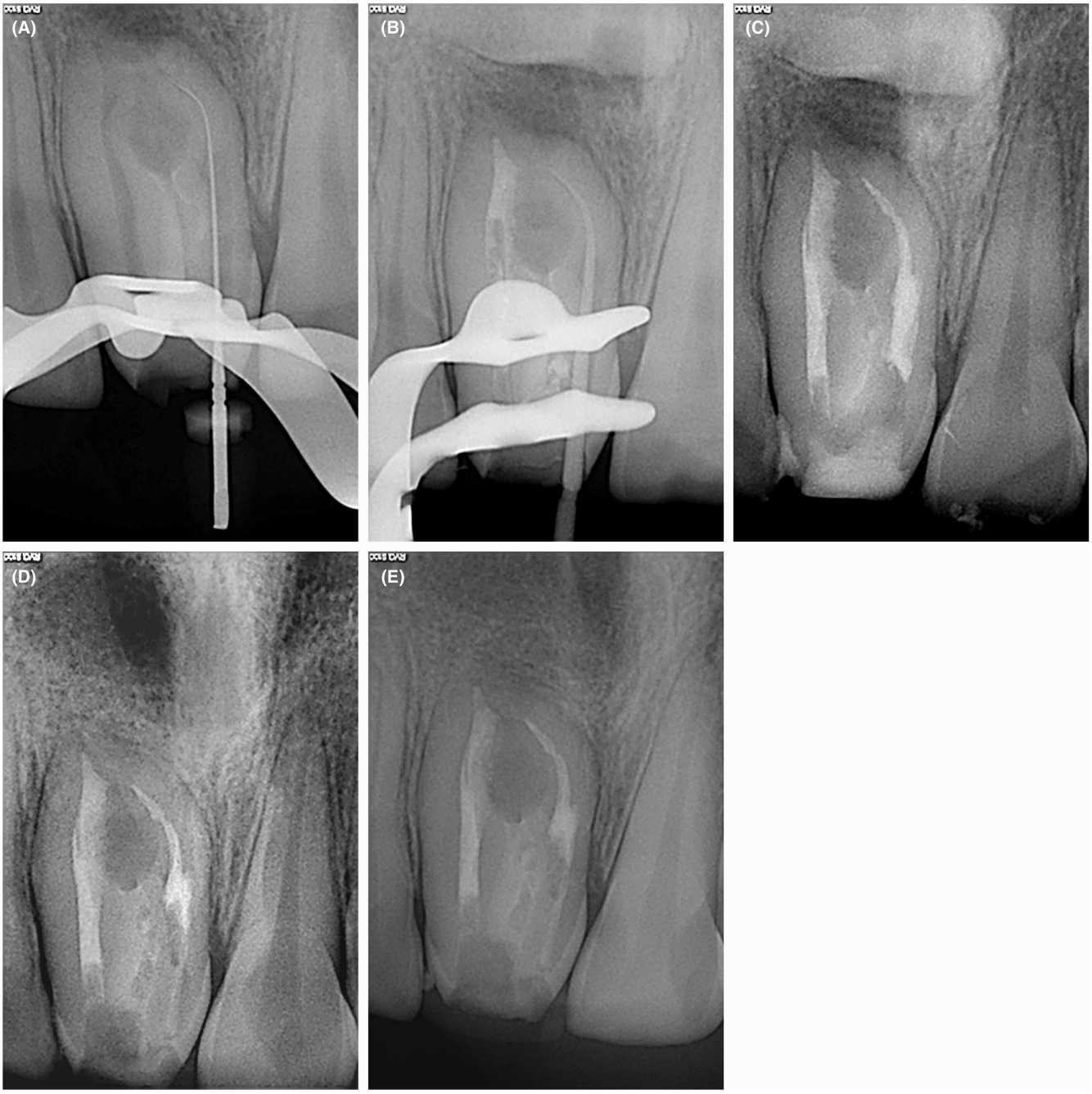

FIGURE 3 Two-dimensional radiography with initial file in the mesial aspect of the canal at the first session.

use of a dressing between treatment sessions, including calcium hydroxide as a popular and well-known intracanal medicament, can be beneficial in eliminating intracanal residual pathogens.[12] Despite its advantages, calcium hydroxide can have a negative effect on the sealing qualities during obturation.[12] Therefore, copious irrigation using NaOCl and EDTA prior to obturation is recommended to overcome the adverse effect of residual intracanal calcium hydroxide on the root canal filling.[12]

Although there are controversies surrounding the use of NaOCl following EDTA due to its adverse effect on dentin,[9,10] in the present case, we did not use NaOCl after EDTA as an irrigating solution. Moreover, for nonsurgical endodontic treatment of DI, the preferred approach is using a large plug at the apical end and root canal obturation using lateral condensation or warm gutta-percha techniques.[8] Various obturation materials, including Biodentine, MTA, and gutta-percha using different sealers, have been suggested.[2]

In the present case, scrolling the axial view in CBCT showed that the invagination space had no connection to the canals. Thus, it had not been filled with bio-ceramic

FIGURE 4 Master apical cone radiography in the second session.

FIGURE 5 Post-treatment radiography in the second session.

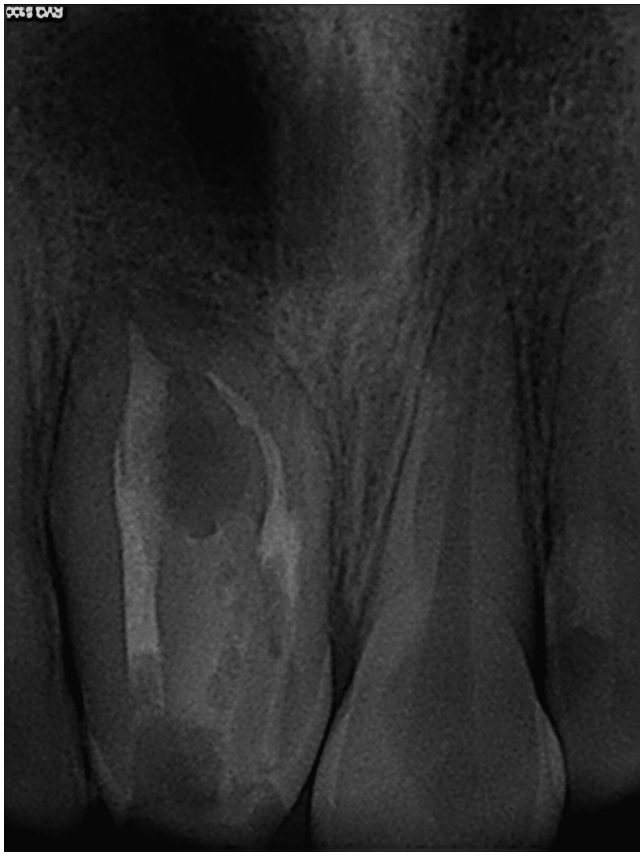

FIGURE 6 Periapical radiography at recall visit 3 months after treatment.

material. Although the coronal aspect of the invagination space had been sealed with MTA, restorative material was applied, subsequently.

Despite its significant challenges, proper endodontic therapy for DI cases may have a positive long-term prognosis.[1]

In the current case, MTA-Angelus was used in the apical portion of the main root canal due to its larger diameter of the apical foramen[13] and short setting time of 15 min.[14] CBCT axial view revealed that the invagination space was not connected to the canals and thus could not be sealed with bio-ceramic materials. Follow-up visits were scheduled over 12 months to monitor the healing process. In case of no improvement, further treatment sequences would be planned.

During the 3-month recall session, an asymptomatic tooth with a healing periapical lesion was observed. The supernumerary impacted tooth was surgically removed, and no further retrograde endodontic treatment was performed on the right maxillary central incisor root. Only granulation tissue may have been removed during the surgical procedure.

A successful clinical and radiographic outcome was observed in this case. However, it cannot be guaranteed that the nonsurgical endodontic treatment alone or the

FIGURE 7 Periapical radiography at 12-month follow-up visit. Note that no internal resorption or peri-radicular lesion is visible.

removal of granulation tissue was solely responsible for the bone fill and complete healing. The use of microscope as a magnification was not possible due to financial constraints, which may be considered a limitation of this study. The use of a microscope can provide a conservative treatment.

AUTHOR CONTRIBUTIONS

Mostafa Ghandi: Conceptualization; investigation; methodology; project administration; supervision; visualization. **Soheila Jadidi:** Writing – original draft; writing – review and editing.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that supports the findings of this study are available in the supplementary material of this article

CONSENT

Written informed consent was obtained from the patient to publish this report in accordance with the journal's patient consent policy.

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