



Endodontic Management of a Maxillary Lateral Incisor with Dens Invagination and Periapical Lesion: A Case Report and Mini Review of the Literature

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ABSTRACT

Dens invagination (DI) is a dental anomaly that can cause pulpal and periapical pathoses of the affected tooth. We describe the treatment of a healthy 18-year-old female with a chief complaint of recurrent facial swelling pertaining to a peg-shaped maxillary lateral incisor with DI. Examinations showed necrosis of the involved tooth with symptomatic apical periodontitis. Cone-beam computed tomography corresponded to Oehlers type II DI. Orthograde endodontic treatment was performed. To completely debride the canal and resolve the persistent purulent discharge, various methods and medicaments were used in separate sessions including passive ultrasonic activation of 5.25% sodium hypochlorite solution, calcium hydroxide mixed with 2% chlorhexidine, and double antibiotic paste as intracanal medicament. After resolution of the symptoms, the root canal and the invaginated space were filled by a mineral trioxide aggregate plug and backfilled with thermoplasticized gutta-percha. At the one-year follow-up, complete bone healing was noted in the affected periradicular area.

Keywords: Anti-Bacterial Agents; Dens in Dente; Periapical Abscess; Root Canal Therapy

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INTRODUCTION

Dens invagination (DI) is a developmental malformation resembling the appearance of a “tooth within a tooth” [1]. The most commonly used classification for this malformation was proposed by Oehlers [2]. This classification is based on the depth of the defect relative to the cemento-enamel junction and communication with periodontal ligament. Gul et al. [3] proposed an additional type IV in which there is lateral communication of the invagination with the periodontium and a lateral canal arises from the main root canal.

The reported prevalence of DI ranges

from 0.3% to 26.1% worldwide [4]. The most frequent tooth with dens invaginatus is the maxillary lateral incisor [5], followed by the maxillary central incisors and mandibular premolars [6]. Double DI in a single tooth has infrequently been reported [7]. The prevalence of this anomaly is reported as 0.68% [8], 1.37% [9], and 3.8% [10] in different regions of Iran. This wide range might be attributed to ethnic factors.

Gallacher et al. [11] proposed a treatment plan for each category of DI as follows: In class I DI, sealing of the invagination with composite resin is considered enough for treatment. If these teeth become necrotic, the

invagination defect and the root canal system must be integrated and obturated as one unit. In class II DI, it is recommended not to seal the defect with composite resin. Instead, the defect should be opened and debrided with ultrasonic devices and sodium hypochlorite. Suppose the ingress of caries results in pulpal necrosis. In that case, root canal therapy must be performed and the defect should become integrated with root canal system using ultrasonic or long shank round bur. Treatment of class III DI needs more precision. It is possible that the dental pulp remains vital, but a periradicular lesion in association with invagination can be observed on the radiograph. In such cases, the invagination should be treated and filled with bioceramics [12]. Proper obturation of the root canal system can also bring about some challenges. It is recommended to use the thermoplastic gutta-percha obturation technique to ensure complete seal of the complexities of the root canal system [11]. In the present case report, management of a large periapical lesion associated with a maxillary lateral incisor with a peg-shaped crown and DI malformation is described.

CASE REPORT

This study was reviewed by the Ethical Committee of Research in Tehran University of Medical Sciences, School of Dentistry (ID: IR.TUMS.DENTISTRY.REC.1399.251).

A healthy 18-year-old female with a non-contributory medical history was referred to the Department of Endodontics with a chief complaint of recurrent dental abscess and pain on the left side of her face. At the time of first clinical examination, no swelling was noticed. Intraoral examination revealed bilateral peg-shaped lateral incisors (Fig. 1). Tooth #10 did not respond to sensibility test and was tender on percussion and palpation. The probing depth of all anterior teeth was within the normal range. On the diagnostic periapical radiograph, a periapical lesion was noticed, which was associated with tooth #10 extending apically to the ipsilateral impacted canine (Fig. 2).



Fig. 1: Intraoral examination showing bilateral peg-shaped lateral incisors

The root canal configuration of tooth #10 corresponded to the Oehlers type II DI. The CBCT evaluation revealed no communication between the invagination and periodontium. The associated periapical lesion extended to the crown of the impacted canine and had not perforated the buccal or palatal cortical plates (Fig. 3).



Fig. 2: Periapical lesion associated with tooth #10 extending apically to the ipsilateral impacted canine. The configuration of the root canal corresponded to Oehlers type II DI.

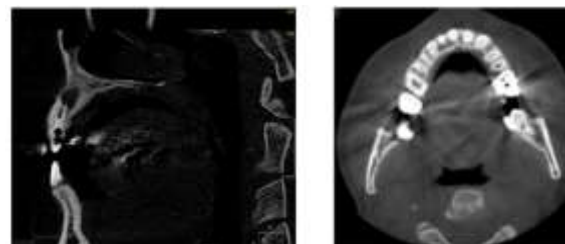


Fig. 3: CBCT revealed no perforation in the buccal or palatal cortical plates. There was no direct contact between the invagination and the periodontium

According to the clinical and radiographic examinations, the diagnosis for tooth #10 was pulpal necrosis and symptomatic apical periodontitis. After obtaining informed consent, root canal treatment was initiated.

In the first session, local infiltration anesthesia was administered by injection of one cartridge of 3% mepivacaine (Oxicaine; Exsir, Iran). A modified access cavity was prepared through the incisal tip of the tooth. Any lateral lumen within the invaginated area was searched under x4 magnification using a dental operating microscope (Carl Zeiss, Oberkochen, Germany).

The invaginated defect was entered by a high-speed diamond bur (Jota, Switzerland) to a depth of 8 mm. Upon exploration with a #12 C-pilot file (VDW, Munchen, Germany) a soft necrotic soft tissue was detected at the apical end of the cavity which dropped into a root canal-like space. The position of the file was confirmed using an electronic apex locator (Root ZX; J Morita, Japan) and periapical radiography. The access opening and root canal negotiation were performed under a dental operating microscope (Carl Zeiss, Oberkochen, Germany). Cleaning and shaping of the root canal system was performed with ProTaper system using Wizard navigator rotary file (Medin, Czech Republic).

A total of 2mL of 5.25% NaOCl was used after each instrument as the root canal irrigant, and the solution was agitated using PD1 ultrasonic tip mounted on NSK ultrasonic device (Varios 970; NSK, Japan) with the power set to level 6 for 20s [13].

Because of persistent purulent intracanal discharge, calcium hydroxide was introduced into the canal as an inter-appointment medicament using 2% chlorhexidine (Shahr Darou, Iran) as the vehicle. In order to avoid chemical interaction between the irrigants, the canal was rinsed with saline solution thoroughly to remove the remnants of NaOCl. Finally, reinforced zinc oxide eugenol (Zoliran, Golchadent, Iran) was placed in the access cavity as a temporary restoration. Two weeks later, the patient was recalled; her tenderness to palpation and percussion had diminished but was not completely resolved. However,

intracanal purulent discharge was persistent. Therefore, double antibiotic paste (DAP) consisting of ciprofloxacin and metronidazole (Rouzdrou, Iran) was prepared by mixing 250 mg of each antibiotic powder with saline to obtain a clinically applicable consistency, and the resultant mixture was used as the intracanal medicament. On the third session, which was scheduled 2 weeks later, the intracanal drainage was substantially controlled. Due to external resorption of the apical part of the root, RetroMTA (BioMTA, Deajon, Seoul, Korea) was placed as an apical plug to provide an adequate seal in the apical portion of the root canal up to the point of invagination defect and temporarily sealed (Fig. 4).



Fig. 4: MTA apical plug placement (retroMTA)

On the next session, the ultimate setting of the RetroMTA was confirmed, and the remaining coronal space of the root canal was reserved for post placement. The access cavity was sealed for a relatively longer period of time using 3mm of light curable glass ionomer (Fuji II LC, GC, Tokyo, Japan) and 1mm of composite resin (3M ESPE, St. Paul, MN, USA) to evaluate the treatment result.

After 3 months, radiographic examination revealed substantial bone formation in the periapical lesion, and clinical examination of the patient revealed no signs or symptoms. In order to maintain the coronal seal during the orthodontic treatment, the MTA apical plug was backfilled using gutta-percha (Meta (Dentsply, Tulsa, OK, USA) with warm vertical compaction technique (Fig. 5). Biomed, Seoul, Korea) and AH26 sealer.

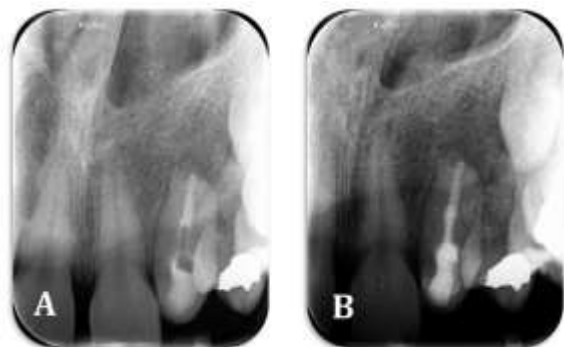


Fig. 5: (A) At 3-month follow up, substantial bone formation in the periapical lesion was observed and clinical examination of the patient revealed no signs or symptoms. (B) Backfilling by warm vertical condensation technique

The access cavity was restored with composite resin. Upon periapical radiographic evaluation after 6 months, complete bone formation was observed in the periradicular area (Fig. 6a). At the one-year follow-up, the patient was asymptomatic, and the periapical radiograph showed bone healing and no evidence of recurrence of the periapical lesion (Fig. 6b).



Fig. 6: (A) Six-month follow-up: complete bone formation in the periradicular area. (B) One-year follow-up: evident bone healing and no evidence of recurrence of the periapical lesion

DISCUSSION

Teeth with DI are more prone to early pulpal pathosis. Therefore, early diagnosis and prophylactic treatment of such cases are recommended [11]. Since it is reported that DI is accompanied by other anomalies such as peg-shaped teeth, impacted canine, etc. [14], observation of these anomalies can lead the dental practitioner to suspect DI and

investigate further for it.

In the present case report, bilateral peg-shaped lateral incisors and impacted canine were also observed. In cases of DI, CBCT is recommended for determination of its classification [15], which plays an essential role in treatment planning. In our case, since the invagination was categorized as Oehlers class II with pulpal necrosis, the treatment plan consisted of debriding the invaginated space along with root canal treatment of the tooth. Since CBCT evaluation revealed that the invaginated defect was close to the root canal system, it was decided to integrate the invagination with the root canal space during debridement and root canal treatment. This was in accordance with a study by Gallacher et al, [11] who suggested this plan for class II invagination.

The use of intra-canal medicaments between treatment sessions has been advocated by some investigators when there is active discharge within the root canal [16, 17]. Calcium hydroxide is the commonly used medicament proven to have antibacterial activity against common endodontic pathogens [18]. The addition of a vehicle with antibacterial properties such as 2% chlorhexidine will further increase the antibacterial effectiveness of the medicament [19]. In a study by Sabrah et al, [20] the effectiveness of triple antibiotic mixture (TAP), DAP, and calcium hydroxide was compared. They indicated that both TAP and DAP were more effective against biofilm formation by *Enterococcus faecalis* and *Porphyromonas gingivalis*. However, there was no significant difference between DAP and TAP. Thus, DAP could be a suitable alternative to TAP with the advantage that it does not cause tooth discoloration. In the present case report, after intracanal placement of calcium hydroxide mixture with 2% chlorhexidine for 2 weeks, the intracanal discharge did not resolve. Thus, it was decided to replace the medicament with DAP. After 2 weeks, the intracanal drainage completely stopped.

In cases of open apex, either due to immaturity of the tooth or root resorption, regenerative endodontic procedures or apexification treatments could be considered [21]. When the

vitality of a tooth is lost early before root development, the roots remain weak, and the tooth is prone to fracture. In addition, the development of the supporting bone is impaired [21].

The ultimate goal of regenerative endodontic procedures is the regeneration of components and the function of the pulp-dentin complex, which will ultimately lead to the prolonged survival of the tooth and its function [21]. Another treatment modality to overcome the lack of apical barrier is to use calcium silicate cements as an apical plug. In this treatment, the procedure is completed in one or two sessions, but root development is not expected. In a systematic review, it was concluded that both of these treatment modalities have a high survival and success rate, and the treatment plan should be made based on the specific characteristics of each case [22].

In this case, because of apical destruction due to inflammatory root resorption and due to complete root development, it was decided to use MTA apical plug to create a barrier in the apex of the root. Invagination can affect the main root canal morphology and cause deformation of the root canal system [4]. Also, the invagination itself might have irregularities that make obturation of the root canal challenging. Thus, it is recommended to fill the root canal with thermoplasticized gutta-percha [11].

In the present case, the MTA plug was placed up to the invagination defect to ensure a three-dimensional seal of the area where invagination and main root canal system came into contact. The coronal portion of the canal was backfilled with warm vertical condensation technique.

CONCLUSION

Endodontic treatment of DI at all stages, including diagnosis, preparation of access cavity, and disinfection and filling of the root canal system and the defective area, are associated with complexities and difficulties. In cases of resistance of the periapical infection to calcium hydroxide intracanal medicament, application of DAP is recommended.

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CONFLICT OF INTEREST STATEMENT

None declared.

REFERENCES

1. Sannomiya EK, Asaumi J-I, Kishi K, da Silva Dalben G. Rare associations of dens invaginatus and mesiodens. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2007;104(2):e41-e4.
2. Oehlers F. 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.
3. Gul M, Adnan S, Umer F. A Variant of the Current Dens Invaginatus Classification. *Front Dent.* 2020;17(28).
4. Alani A, Bishop K. Dens invaginatus. Part 1: classification, prevalence and aetiology. *Int Endod J.* 2008;41(12):1123-36.
5. Thakur S, Thakur NS, Bramta M, Gupta M. Dens invagination: A review of literature and report of two cases. *J Nat Sc Biol Med.* 2014;5(1):218.
6. Chen L, Li Y, Wang H. Investigation of dens invaginatus in a Chinese subpopulation using Cone-beam computed tomography. *Oral Dis.* 2020;27(7):1755-60.
7. Satvati SA, Shooriabi M, Sharifi R, Parirokh M, Sahebnasagh M, Assadian H. Co-existence of two dens invaginations with one dens evagination in a maxillary lateral incisor: A case report. *J Dent (Tehran).* 2014;11(4):485.
8. Shokri A, Poorolajal J, Khajeh S, Faramarzi F, Kahnamousi HM. Prevalence of dental anomalies among 7-to 35-year-old people in Hamadan, Iran in 2012-2013 as observed using panoramic radiographs. *Imaging Sci Dent.* 2014;44(1):7-13.
9. Saberi EA, Ebrahimipour S. Evaluation of developmental dental anomalies in digital panoramic radiographs in Southeast Iranian Population. *J Int Soc Prev Community Dent.* 2016;6(4):291-5.
10. Haghanifar S, Moudi E, Abesi F, Kheirkhah F, Arbabzadegan N, Bijani A. Radiographic Evaluation of Dental Anomaly Prevalence in a Selected Iranian Population. *J Dent (Shiraz).* 2019;20(2):90-4.
11. Gallacher A, Ali R, Bhakta S. Dens invaginatus: diagnosis and management strategies. *Br dent J.* 2016;221(7):383-7.
12. Jitaru S, Hodisan I, Timis L, Lucian A, Bud M. The use of bioceramics in endodontics-literature review. *Clujul Med.* 2016;89(4):470.

13. van der Sluis LW, Versluis M, Wu MK, Wesselink PR. Passive ultrasonic irrigation of the root canal: a review of the literature. *Int Endod J*. 2007;40(6):415-26.
14. Kim J-H, Choi N-K, Kim S-m. A retrospective study of association between peg-shaped maxillary lateral incisors and dental anomalies. *J Clin Pediatr Dent*. 2017;41(2):150-3.
15. Różyło TK, Różyło-Kalinowska I, Piskórz M. Cone-beam computed tomography for assessment of dens invaginatus in the Polish population. *Oral radiol*. 2018;34(2):136-42.
16. Sjögren U, Figdor D, Persson S, Sundqvist G. Influence of infection at the time of root filling on the outcome of endodontic treatment of teeth with apical periodontitis. *Int Endod J*. 1997;30(5):297-306.
17. Silveira AMV, Lopes HP, Siqueira Jr JF, Macedo SB, Consolaro A. Periradicular repair after two-visit endodontic treatment using two different intracanal medications compared to single-visit endodontic treatment. *Braz Dent J*. 2007;18(4):299-304.
18. Mohammadi Z, Dummer PMH. Properties and applications of calcium hydroxide in endodontics and dental traumatology. *Int Endod J*. 2011;44(8):697-730.
19. Sinha N, Patil S, Dodwad PK, Patil AC, Singh B. Evaluation of antimicrobial efficacy of calcium hydroxide paste, chlorhexidine gel, and a combination of both as intracanal medicament: An in vivo comparative study. *J Conserv Dent*. 2013;16(1):65.
20. Sabrah AH, Yassen GH, Gregory RL. Effectiveness of antibiotic medicaments against biofilm formation of *Enterococcus faecalis* and *Porphyromonas gingivalis*. *J Endod*. 2013;39(11):1385-9.
21. Hameed MH, Gul M, Ghafoor R, Badar SB. Management of immature necrotic permanent teeth with regenerative endodontic procedures—a review of literature. *J Pak Med Assoc [Internet]*. 2019;69(10):1.
22. Torabinejad M, Nosrat A, Verma P, Udochukwu O. Regenerative endodontic treatment or mineral trioxide aggregate apical plug in teeth with necrotic pulps and open apices: a systematic review and meta-analysis. *J Endod*. 2017;43(11):1806-20.