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Case Report

Management of type III Dens Invaginatus with a periapical lesion in a maxillary lateral incisor: A case report

Parthasarathi Mondal[1], Baishakhi Sarkar[1], Snigdho Das[2]*

[1]*Dept. of Conservative Dentistry & Endodontics, Dr.R.Ahmed Dental College and Hospital, Kolkata, West Bengal, India*
[2]*Ramakrishna Sarada Mission Matri Bhavan Hospital, Kolkata, West Bengal, India*

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ABSTRACT

Dens Invaginatus (DI) is a developmental abnormality, usually affecting the maxillary incisor teeth, particularly lateral incisors. These cases usually present technical difficulties concerning their management owing to their aberrant canal morphology. Conventional root canal therapy, periapical surgery, and extraction have been reported as treatment modalities for such anomalies. The following case report depicts surgical endodontic management of an Oehler's Type III DI involving a maxillary lateral incisor associated with periapical lesion aided by cone beam computed tomography (CBCT) and with the use of mineral trioxide aggregate (MTA), hydroxyapatite bone graft and platelet-rich fibrin (PRF) membrane. At 12 months post-treatment, the patient did not report any eventful episodes, and the size of the periapical lesion was markedly reduced.

1. Introduction

Dens invaginatus (DI) is a developmental malformation resembling the appearance of a "tooth within a tooth." Although there is no consensus concerning the definitive etiologic factor causing DI, it is thought to arise from the infolding or a deepening of the enamel organ into the dental papilla during odontogenesis before the calcification process.[1] The reported prevalence of DI ranges from 0.3 to 26.1% worldwide. Kirzioglu et al. reported that the most affected teeth were maxillary lateral incisors, followed by maxillary central incisors and maxillary canines.[2–4]

Though different classifications have been suggested, Oehlers 3 classification is most commonly followed, which classified DI into three categories according to the depth of penetration and communication with the periapical tissue or periodontal ligament. In type I, an enamel-lined minor invagination occurs within the coronal part of the crown without extending beyond the cementoenamel junction (CEJ). In type II, an enamel-lined invagination extends into the root, beyond the CEJ, and remains as a blind sac without reaching the periodontal ligament, or periapical tissues. In type IIIa, an invagination is found extending through the root and opening laterally in the periodontal tissues, while in type IIIb the present invagination extends through the root while opening apically to the periapical tissues.

The complex anatomy of DI makes a conservative endodontic treatment of such teeth difficult and unpredictable, thus correct diagnosis with the help of modern diagnostic aids such as cone beam computed tomography (CBCT) has been suggested.[5] Management involves a combination with surgical treatment or sometimes extraction of such a tooth is necessary.[6,7] The current case report describes surgical management of type IIIb DI with a periapical pathology associated with a maxillary lateral incisor.

* *Corresponding author*.
E-mail address: snigdho1991@gmail.com (S. Das).

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2. Case Report

A 42-year-old female patient reported to the Department of Conservative Dentistry and Endodontics with a chief complaint of frequent pain which was dull in the maxillary left lateral incisor, with a non-contributory medical history. Clinical examination revealed an absence of mobility and no response to palpation and percussion tests. The pulp sensibility test was carried out using a Cold test(Coltene Roeko Endo-Frost Spray, Coltene Whaledent, Langenau, Germany), and an Electric Pulp tester(Waldent Pulp Tester, Waldent Innovations, New Delhi, India); both of which showed a negative response in tooth #22, although all the adjacent teeth responded within normal limits. An intraoral periapical radiographic (IOPAR) examination revealed periapical radiolucency associated with #22 and the presence of enamel-lined invagination (which had opened into the periodontal ligament) along the entire length of the root of #22 (Figure 1 a). CBCT scan(MyRay Dental Imaging, Imola, Italy) revealed the communication between the invagination and periodontium (Figure 1b(i-iii). Based on clinical examination and by CBCT scan and IOPAR evaluation, a diagnosis of pulpal necrosis with asymptomatic apical periodontitis in tooth #22 associated with type IIIb DI was made.

After obtaining informed consent,root canal treatment was planned for tooth #22. The concerned tooth was anesthetized with 2% lignocaine (1:80000) (Lignox 2%, Indoco,Thane, India) and isolated with a rubber dam. Access cavity preparation was done to gain access into the pulp chamber, and one main canal and two pseudo canals were identified (Figure 1c). The three canals were negotiated with size #15K files (Mani Inc., Japan), and the working length was established using an apex locator (Propex Pixi, Dentsply Sirona, USA) and periapical radiography. Following access preparation, an intensive drainage of purulent exudate from the canals of #22 was found. Bio-mechanical preparation of canal system of #22 was performed with hand files up to size #55K using a step-back technique. 1 ml of 5.25% sodium hypochlorite (NaOCl) solution (Prime Dental Products Pvt. Ltd, India) was used as the root canal irrigant after each instrument, and the solution was activated using a sonic irrigant activation system (Endoactivator, Dentsply Sirona, USA) for one minute with #35/0.04 polymer tip at 10,000 cycles per minute(cpm). Then calcium hydroxide Ca(OH)2 paste (Ultracal, Ultradent Inc; South Jordan) was placed into the canals as an intracanal medicament for 2 weeks and the access cavity was temporized with Caviton (GC Corporation,Tokyo,Japan).

Two weeks later, the patient was recalled and noted that intracanal exudate was still present, suggestive of a resistant infection in the apical region. Intracanal medication was repeated every 2 weeks to treat the draining exudate. The extent of the periapical pathology and the aberrant root structure was considered to hamper the successful accomplishment of an orthograde endodontic treatment along with persistent exudation even after twelve weeks of repetitive intracanal dressings, surgical intervention was deliberated.

At the next visit, scheduled for obturation of #22, intracanal Ca(OH)2 was flushed out with activation by Endoactivator. Final irrigation was performed using 1 ml each of 5.25% NaOCl, and 17% EDTA (Ethylene diamine tetra acetic acid) alongwith activation with an Endoactivator for one minute with #35/0.04 polymer tip at 10,000 cycles per minute(cpm)and with an intermediate and final flushing of the canals with 10 ml of saline. Following this, the canals were dried with sterile paper points. The master cone radiograph was taken to ensure apical fit and the canals of #22 were obturated (Figure 1d) by the lateral compaction technique using gutta-percha cones and AH Plus sealer (Dentsply Sirona, USA). The access cavity was restored with a nano-hybrid composite resin (Brilliant NG, Coltene-Whaledent).

The patient was scheduled for endodontic surgery a week later. Under local anesthesia, a full-thickness mucoperiosteal flap was reflected and considerable labial cortical bone loss was seen corresponding to the periapical pathology. The periapical tissue was carefully enucleated (Figure 1e), apicoectomy of #22 was done and the retrograde cavity, which was inverted-cone in shape and with 0° bevel was prepared using ultrasonic tips (ED-10 and ED-11, Guilin Woodpecker Medical Instruments Co.Ltd, China). Then 3 mm of mineral trioxide aggregate (MTA) (Angelus, Brazil) was placed as an apical barrier. The osseous defect was filled with a hydroxyapatite bone graft (G-Bone, Surgiwear Ltd; India) mixed with platelet-rich fibrin (PRF) (Figure 1f) and a PRF membrane was placed over it (Figure 1g) PRF was prepared following Choukroun's Protocol[7] from patient's blood. Flap repositioning was done followed by suturing with 3/0 black silk sutures (Figure 1h). Figure 1i shows the immediate post-operative radiograph. The enucleated specimen was stored in 10% formalin(Nice Chemicals, Kochi, India) and sent for histopathological evaluation which confirmed the presence of a peri-radicular cyst (Figure 1 j). The patient was scheduled for consequent follow-ups.

Upon IOPA radiographic evaluation (Figure 2a(i)) and CBCT scans after 6 months, the patient was asymptomatic, and satisfactory bone formation was found in the periradicular region (Figure 2a(ii-iv)). At the 12-month follow-up, the IOPA radiograph (Figure 2b(i)) and CBCT scans (Figure 2b(ii-iv)) showed bone healing and did not denote any recurrence of the periapical lesion.

3. Discussion

Comprehensive studies have found that teeth affected with DI are susceptible to developing pulpal pathosis.[8,9] The

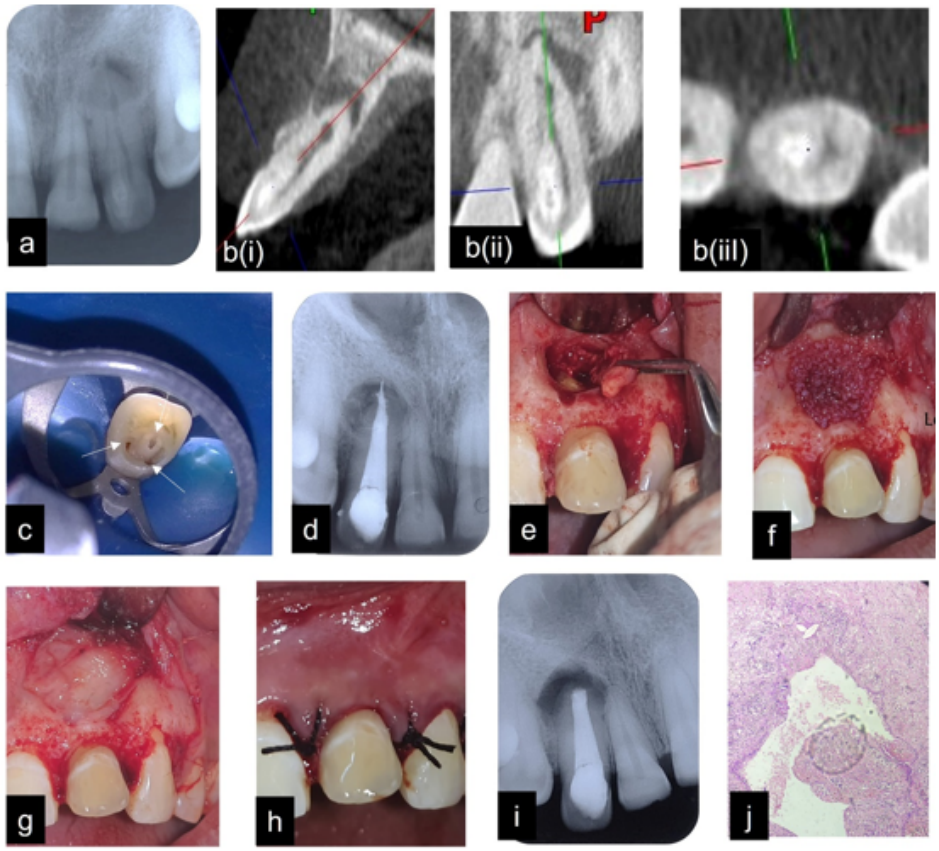

Figure 1: Clinicalsteps: **a**: Pre-operative radiograph; **b:** Pre-operative cone-beam computed tomographic scan in(**i**)sagittal section(**ii**)coronal section(**iii**)axial section; **c**: access opening showing three orifices(arrows); **d:** Post-obturation radiograph; **e:** Enucleation of peri-apical tissue; **f:** Placement of bone graft mixed with platelet-rich fibrin(PRF); **g:** Placement of PRF membrane over bone graft; **h:** Sutures placed; i: Immediate post-operative radiograph; **j:** Photomicrograph showing radicular cyst (10X magnification)

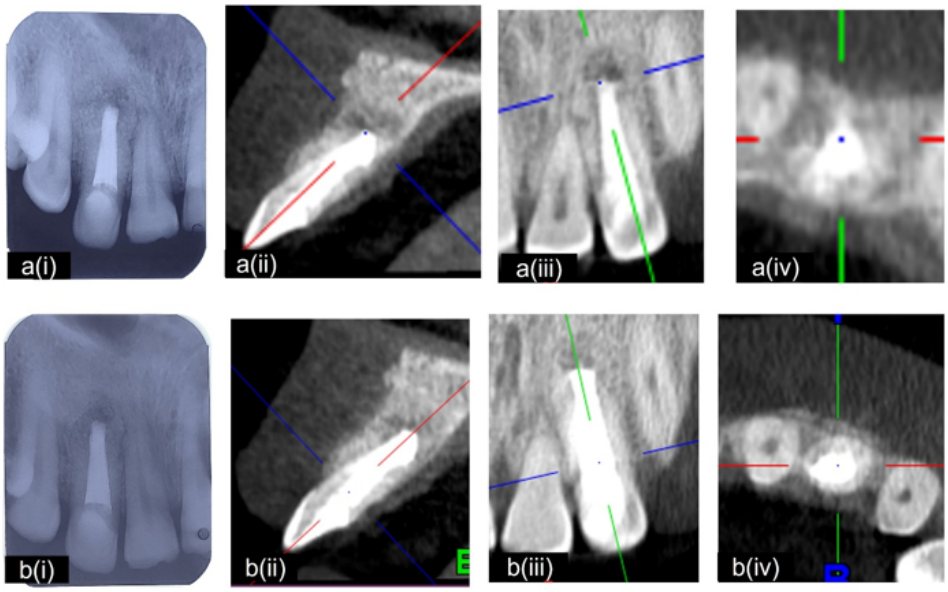

Figure 2: a: 6-month follow-up and **b:** 12-month follow-up as seen in (**i**): Periapical radiograph; (**ii**): Sagittal cone-beam computed tomographic scan; (**iii**)coronal cone-beam computed tomographic scan; (**iv**) Axial cone-beam computed tomographic scan

invagination may offer a space to shelter microorganisms and endorse caries progress and bacterial infection into the pulp space. Furthermore, it can also occur without any evidence of dental caries or a history of trauma.[9,10] Thus, the etiology of the chronic periapical lesion in the present case was probably the passage of microorganisms through the invagination defects. Therefore, there is a recommendation for an early diagnosis and preventative treatment of such cases.[8]

When the tooth's pulp with DI is necrotic, the entire root canal system needs to be treated. Occasionally, treating the root canal and invagination separately involves a viable option.[3]

Care should be taken when joining the root canal with the invagination because it may weaken the tooth structure or compromise the apical constriction. Therefore, attempting to keep the invagination and root canal separately during endodontic treatment is advisable whenever possible and it is followed in the present case report. Identifying the invagination type through a comprehensive radiographic evaluation is vital for choosing the ideal treatment.[11] Compared to tomographic techniques, periapical radiographs are limited in revealing the type, extension, and intricate morphology of DI, as well as the actual bone loss. Thus, CBCT is recommended to determine its classification, which plays an essential role in treatment planning.

According to Pai et al., the complex anatomy of DI becomes problematic and usually complicates conservative endodontic treatment, especially when periapical lesions exist.[12] The conventional endodontic therapy associated with periradicular surgery has been proposed only when conventional treatment is associated with post-treatment disease or when it is not possible to locate the invaginated canal through a coronal access cavity.[13]

Teeth infected and with necrotic pulp may be associated with radicular cysts.[14] In the present case report, histopathological examination confirmed the presence of a radicular cyst. To provide better bone growth and quicker bone healing, a mixture of hydroxyapatite crystal and PRF was placed inside the osseous defect along with a PRF membrane covering. PRF contains an assembly of growth factors and combining it with bone graft promotes the induction of a strong and thick periosteum, and acts as a barrier between the soft tissue and bone compartments, thereby promoting optimum bone and soft tissue regeneration.[15]

The case presented herein is a decent example of the challenges involved in treating cases with DI. Endodontic microsurgery was chosen as a reliable treatment option in our present case because there were qualms regarding the accomplishment of a predictable orthograde endodontic treatment.

4. Conclusion

After advances in the endodontic armamentarium, teeth with DI even with their aberrant anatomy can be preserved. Early identification and prophylactic treatment of these lesions is vital in preventing pulpal pathology from developing and avoiding complex and specialized endodontic treatment. With precise clinical acumen, definitive diagnosis, and treatment planning, every effort should be made by the clinical to retain these teeth as a professional asset rather than a liability.

5. Source of Funding

None.

6. Conflict of Interest

None.

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Author biography

Parthasarathi Mondal, Associate Professor

Baishakhi Sarkar, Formerly Postgraduate Student

Snigdho Das, Consultant Dental Surgeon https://orcid.org/0000-0002-9061-748X

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