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Unravelling the Complexity : A Case Report of Dens Invaginatus

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ABSTRACT

Dens invaginatus, initially observed in 1794 when found in a whale tooth by Ploquet, has been identified by various names like dens in dente or dentoid in dente. Cone beam computed tomography (CBCT) offers intricate 3D insights into the complex anatomical variations of this malformation. This case report sheds light on the diagnosis and procedural management of dens invaginatus.

KEYWORDS

Dens invaginatus; Dentoid; Cone beam computed tomography

INTRODUCTION

Dens invaginatus (DI) arises from developmental irregularities during tooth formation, where the enamel organ folds into the dental papilla, creating a small tooth within the pulp chamber [1]. This anomaly, first documented by dentist Socrates in 1856, has been termed variously, including dens in dente, dentoid in dente, and others [2]. The folding process results in organic material accumulation beneath the enamel, making these areas susceptible to bacterial colonization and early caries formation, eventually leading to pulp deterioration [2]. Several theories attempt to explain the origin of dens invaginatus, such as infection, trauma, or pressure on dental arches during tooth development, but a conclusive cause remains elusive. There have been numerous attempts to classify DI. The most widely used classification system was produced by Oehler [3].

An understanding of these categories will help when discussing the appropriate treatment options for each lesion [4].

Conventional radiographs have long been the standard for diagnosing dens invaginatus, but in recent years, three-dimensional imaging has made significant strides in endodontics. Compared to traditional two-dimensional imaging, this advanced technique offers superior analysis of root canal anatomy. Studies have shown that the prevalence of dens invaginatus detected by cone beam computed tomography (CBCT) is notably higher than with traditional imaging methods. CBCT is therefore indispensable for diagnosing and assessing the prevalence of dens invaginatus. Given the importance of early

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detection and treatment for improving the prognosis of affected teeth, any suspicion of this anomaly warrants investigation with CBCT [5,6].

This article presents a case of DI involving the maxillary lateral incisors along with periapical lesion and blunderbuss canal.

CASE REPORT

A 29-year-old male patient presented to the Conservative Dentistry Department complaining of swelling and pain in the upper left incisor. Upon investigation, it was discovered that the patient had suffered a fall from a bike seven years prior and had previously been advised to undergo extraction of tooth #22, followed by implant placement. However, the patient had not pursued treatment due to reluctance for extraction. Clinical examination of the maxillary left lateral incisor revealed tenderness to percussion but no mobility. A palato-gingival groove examination showed normal periodontal probing depths. Radiographic assessment indicated an uncomplicated crown-root fracture of tooth #22 Figure 1(a) and Figure 1(b), classified according to Andreason et al. Pulp sensibility tests elicited no response. Further radiographic evaluation, including CBCT, confirmed the presence of a large periapical lesion Figure 2 (a) with an open apex and confirmed the suspicion of dens invaginatus, classified as Type II Figure 2(c). The dimensions of the periapical lesion measured 14.12 mm × 13.82 mm Figure 2(a). The patient was informed about both surgical and non-surgical management options, wherein he chose the latter.

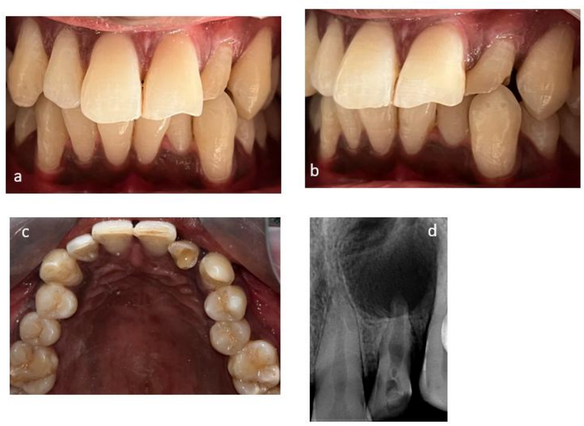

Figure 1: **(a)** Front profile image; **(b)** Left lateral profile image; **(c)** Occlusal view of maxillary arch indicating the palatal incline if the tooth #22 after trauma; **(d)** Pre-operative radiograph.

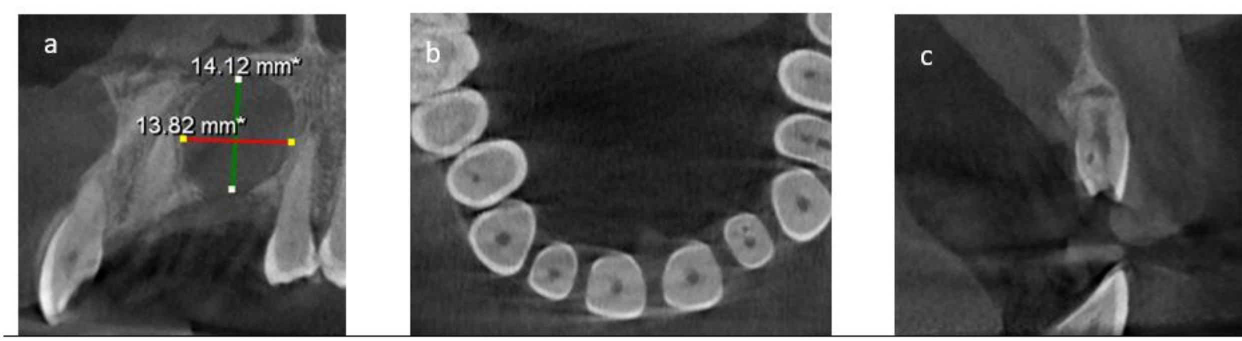

Figure 2: **(a)** Longitudinal section; **(b)** Axial section; **(c)** Cross section.

The patient was briefed on the procedure and consent for the same was obtained. Local anesthesia was administered, and the tooth was isolated with a rubber dam Figure 3(a). Using a dental operating microscope, access cavity was gained with a no. 2 endo-access bur, followed by refinement of the cavity outline with an Endo-Z bur. The location of the orifice was confirmed with a DG-16 probe Figure 3(b), and an orifice shaper rotary file was used to widen the access point. An exudate was observed from the canal Figure 3(c), which was flushed with an irrigating solution. The working length was determined using an Apex Locator and confirmed with an X-ray, measuring 20.5 mm Figure 3(d). Given the thin radicular dentin wall, a preference was given to chemo-mechanical preparation. The canal was irrigated with 10 ml of 3% NaOCL using a side-vented needle and activated with a passive ultrasonic system, repeated thrice, followed by a final flush with saline. A fresh mixture of double antibiotic paste (Ciprofloxacin & Metronidazole) was prepared and introduced into the canal. Three sessions of DAP (inter-appointment medicament) were placed until healing of the periapical lesion was evident Figure 4 (a); 4(b) and 4(c).

In the second appointment, as the canal was dry without any exudate, the plan was to perform MTA obturation. With the tooth isolated using a rubber dam and under the dental operating microscope, MTA increments were placed using a sterilized amalgam carrier. These increments were then condensed with an MTA plugger Figure 5(a). An immediate X-ray was taken to verify the obturation and ensure there were no voids within the canal. After achieving a three-dimensional seal of the main canal, the procedure to address the type 2 dens invaginatus was evaluated.

ISO no. #6, #8, and #10 K files were sequentially employed to navigate through the type 2 dens invaginatus pathway. Subsequently, a size 17.4% glide rotary file was utilized for further negotiation. The final preparation was concluded at 20.4%. The anomaly was then sealed Figure 5(b).

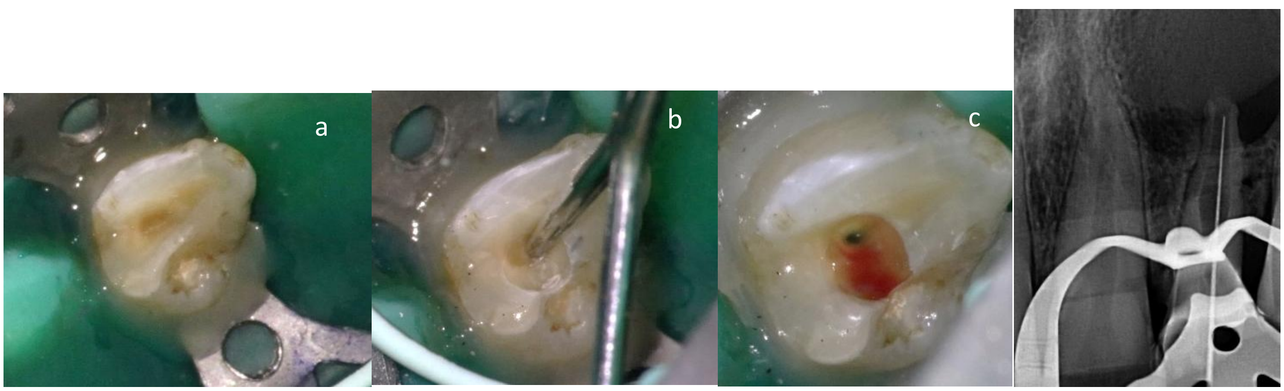

Figure 3: **(a)** Preoperative clinical image with rubber dam isolation; **(b)** DG-16 to confirm orifice location; **(c)** Exudate oozing from canal; **(d)** Working length determination 20.5 mm.

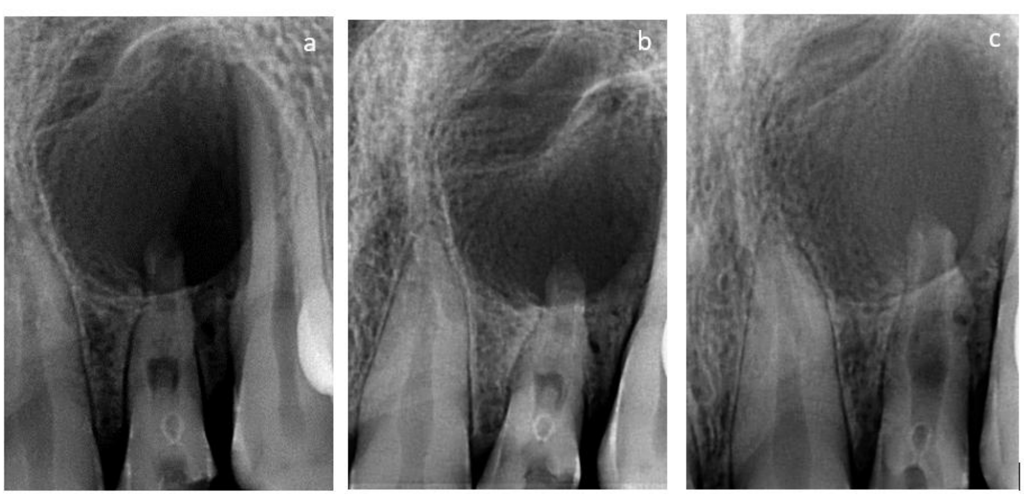

Figure 4: (a); (b); and (c) showing healing of periapical lesion after 3 sitting of Double antibiotic paste as inter appointment medicament.

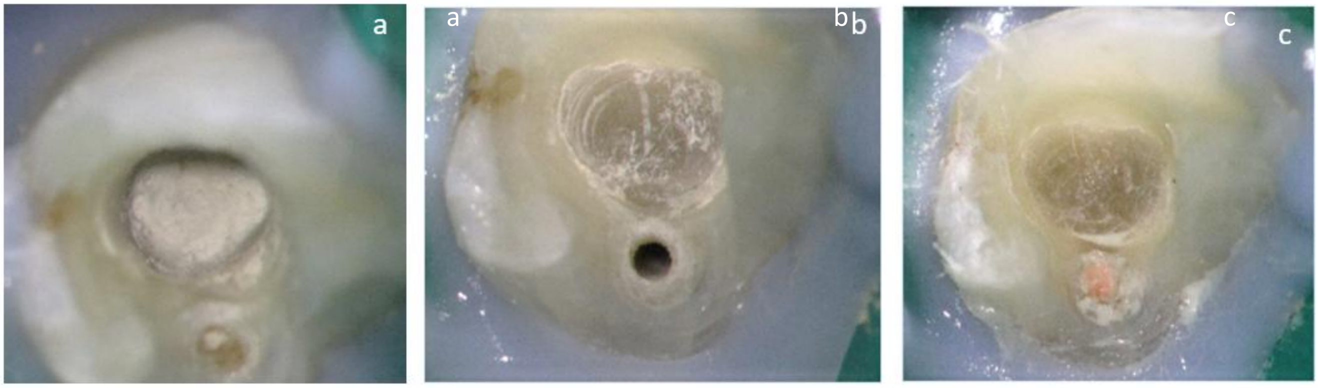

Figure 5: (a) Microscopic view with MTA obturation; **(b)** Biomechanical preparation of dens invaginatus type 2 upto 20.4%; **(c)** Obturation.

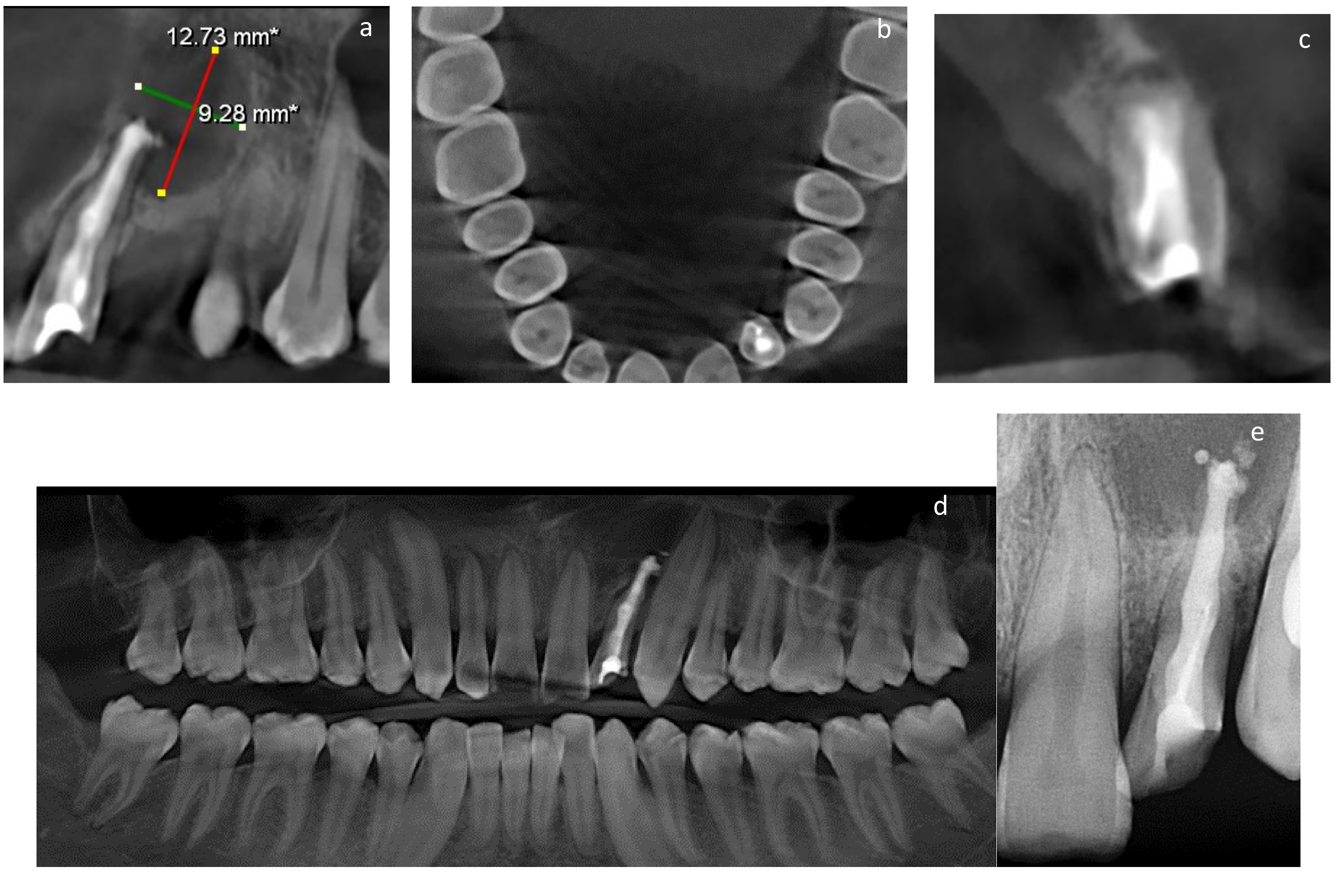

Figure 6: (a) Longitudinal Section; **(b)** Axial section; **(c)** Cross section; **(d) and (e)** Post obturative image.

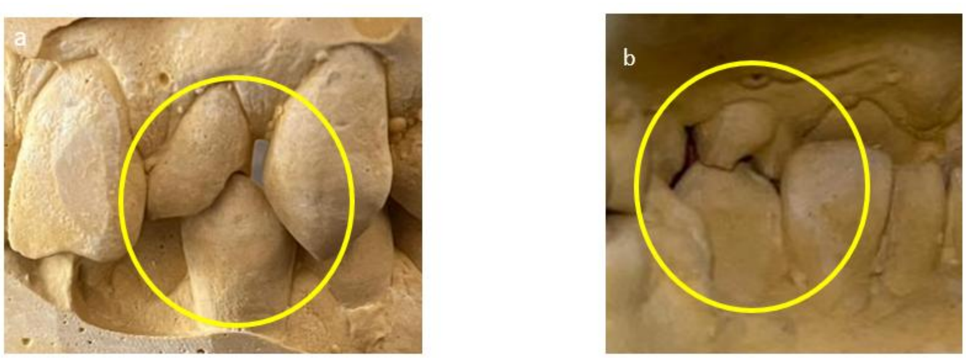

Figure 7: (a) and **(b)** Assessment of patient's occlusion.

DISCUSSION

In this the case reported, non-surgical endodontic treatment was employed to effectively address a root canal anomaly accompanied by a significant periapical lesion on tooth #22. Rubber dam isolation was implemented during the endodontic procedure to uphold a thoroughly sterile environment, and a dental operating microscope was utilized to ensure optimal visibility and accessibility.

To ensure accurate diagnosis, CBCT was employed as a diagnostic aid. In a systematic review and meta-analysis conducted by Sara et al., the prevalence of dens invaginatus was examined using CBCT as the diagnostic method. The findings revealed a significantly higher prevalence (9%) of dens invaginatus when diagnosed with CBCT compared to two-dimensional imaging techniques (ranging from 0.25% to 7.7%). Hence, CBCT emerges as a crucial and effective tool for the precise diagnosis and treatment planning of this dental anomaly. These findings align with those of Capar et al., who also noted a disparity in prevalence between CBCT (10.7%) and conventional radiography (3%) [7].

The management of dens invaginatus (DI) varies based on the pulpal and periapical condition as well as the complexity of the anatomy.

For Oehlers' type I or II cases with a healthy pulp, prophylactic measures are recommended. Invaginations on the lingual or occlusal surface can be addressed by acid-etching followed by sealing the pit with flowable composite. If pulpal necrosis is present, root canal treatment is indicated. Previous studies have described the removal of an invaginated mass during root canal treatment [4].

Surgical intervention for periapical pathologies is not always obligatory, as they often respond well to appropriate nonsurgical endodontic treatment. Before considering surgery, a nonsurgical approach should be prioritized. Patients typically exhibit greater psychological apprehension toward surgical procedures compared to nonsurgical ones. Additionally, it's essential to acknowledge the potential risks and complications associated with surgical procedures, particularly in medically compromised patients. Therefore, initial management of inflammatory periapical lesions should primarily involve conservative nonsurgical methods. However, the importance of considering conservative non-surgical approaches, such as intracanal medicaments, should not be overlooked [8].

Calcium hydroxide (CH) is widely utilized in endodontics due to its strong alkalinity, which facilitates tissue dissolution, promotes hard tissue formation for repair, and exhibits bactericidal properties [9]. However, studies have indicated CH's limited effectiveness in completely eliminating bacterial cells. Haapasalo and Orstavik found that even superficially, CH failed to eradicate E. faecalis in dentinal tubules. Antibiotics are employed in dentistry both systemically and topically, with local administration achieving higher concentrations within the root canal. Pai et al. demonstrated that CH and triple antibiotic paste (TAP) effectively manage interappointment flare-ups. To address TAP's disadvantage of causing discoloration, double antibiotic paste (DAP), comprising only metronidazole and ciprofloxacin, has been successfully utilized in endodontic regeneration as a substitute for TAP [9,10]. Sabrah et al. noted that both TAP and DAP exhibit significant residual antibacterial effects in human radicular dentin, with DAP demonstrating a longer residual antibacterial effect compared to TAP. Therefore, in the current study, DAP was selected as the preferred choice of medicament for interappointment dressing 10.

MTA obturation has the potential to release calcium ions through dentinal tubules into resorption defects, which can promote the repair of surrounding tissues. Additionally, MTA has been shown to enhance alkaline phosphatase expression and activity in periodontal ligament fibroblasts [11,12]. At a cellular level, these positive biological effects are attributed to various factors such as the induction of bone morphogenetic protein-2 (BMP-2) and stimulation of transforming growth factor beta-1 (TGF ß-1), which encourage bone growth and osteocalcin stimulation, as well as the stimulation of interleukin production, promoting overgrowth of cementum [13]. Utilizing MTA obturation could therefore be a beneficial approach to enhancing healing outcomes, particularly in cases of severe inflammatory root resorption in young permanent teeth [14].

Six months post-treatment, the patient returned for evaluation, and a CBCT analysis indicated substantial healing in the periapical region of tooth #22, with no signs of sinus tract or swelling Figure 6(a-e). The patient's occlusion was assessed, revealing premature contact between the lower canine and the upper left lateral incisor Figure 7(a) and 7(b). This premature contact could adversely affect the healing of tooth #22. Therefore, an interdisciplinary approach involving the Department of Orthodontics was proposed. Further plan involves tipping movement of tooth #22 to ensure its placement in a functional position [15].

CONCLUSION

To sum up, the precise cause of dens invaginatus (DI) remains unclear, and its occurrence varies depending on the population and geographic region studied. Since teeth affected by DI are susceptible to pulp-related issues, it's advisable for at-risk individuals to undergo regular clinical and radiographic assessments. Clinicians should have a good grasp of the dental anatomy and utilize modern endodontic tools like operating microscopes and ultrasonic instruments.

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