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Rare Radicular form of Dens Invaginatus

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Abstract

Dens invaginatus is one of developmental malformations of teeth, which most commonly affects permanent maxillary lateral incisors. The incidence is rare in our population. The malformation has a wide array of morphological varieties, which usually cause a rapid dental pulp necrosis. Endodontic therapy is very difficult. The authors describe the etiology, classification, incidence, diagnostics and treatment of this anomaly. In this work they also describe a case of the rare radicular form of this tooth anomaly in a 11-year-old girl. Towards the end, the authors put emphasis on thorough examination of lateral permanent incisors shortly after eruption, which can help detect this anomaly in time.

Keywords: developmental malformation teeth; dens anomaly; dens in dente.

1. Introduction

Dens invaginatus is an anomaly, and a developmental malformation of the tooth dependent on invagination of enamel organ into dental papilla, starting at the crown and sometimes extending up to the root of the tooth before calcification [1]. In permanent dentition, the problem predominantly develops in maxillary lateral incisors (about 8% of cases), then in maxillary central incisors, premolars and less often in molars. Literature also describes cases of bilateral incidence and incidence in deciduous teeth [5]. Ploquet first described this malformation in 1794 on a whale case, while in 1855, Salter described it as “a tooth within a tooth”. In humans it was first described in 1856 by Socrates [3]. Number of different terms exists for this anomaly in literature. Based on x-ray observations Busch described it in 1897 as “dens in dente”. The name “dens invaginatus” seems to be the most appropriate since it reflects invagination, or rather insertion of the outer part – enamel, into the inner part – dentin, creating pockets and dead space.

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Foreign literature provides additional synonyms, such as invaginated odontome, dilated gestant odontome, dilated composite odontome, tooth inclusion and denstelescope [4]. Affected teeth exhibit deep invaginations of enamel and dentin from foramen caecum, or from the tip of a cuspid and can extend deep into the root. There is a wide variety of morphological changes that frequently result in a necrosis. Root canal treatment might pose serious problems and in many cases it results in an extraction.

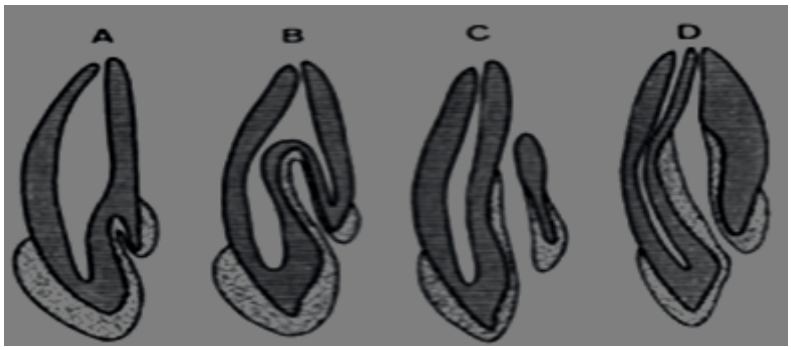
1.1. Etiology

The etiology of the malformation is still unclear and conflicting. Number of theories try to describe the possible mechanisms behind this anomaly.

One of them states that the pressure of dental arch during growth is responsible for enamel organ deviation. Another theory points to the failure in growth of the internal enamel epithelium or that the cause might be the result of fast and aggressive spread of inner enamel epithelium to dental papilla. Other authors talk abou the so called “twin theory,” which is basically a merger of two tooth germs. Other causes for this anomaly could be an infection, trauma or genetic factor [4].

1.2. Dens invaginatus classification

First classification of invaginated teeth was created in 1953 by Hallet. The most frequently used so far is Oehlers classification from 1957 shown in Figure 1. It describes three forms of coronary invagination [7].



TYPE I TYPE II TYPE IIIA TYPE IIIB

Figure 1: Oehlers classification of dens invaginatus [7].

Typ I shows an enamel-lined type which occurs around the crown boundary and which may not exceed the cementoenamel junction.

Type II shows an enamel-lined type that affects the root, but resides in a blind pocket of sort that may or may not communicate with dental pulp.

Type IIIA is a form which penetrates through the root and communicates with periodontal ligament space

laterally through a pseudo foramen. Usually does not communicate with dental pulp, which is pressed at the root.

Type IIIB is a form of invagination that penetrates the root and perforates apical area through

pseudo foramen. Invagination can be completely lined with enamel, but it is often lined with cement.

Radicular forms of invagination are very rare. In 1972, Schulze and Brand compiled a detailed classification which also involved root malformations /Figure 2/.

This classification divides possible invaginations into those which have an onset on incisal edge, or those that start at the tip of the crown. It also describes different morphological configurations of the root [8].

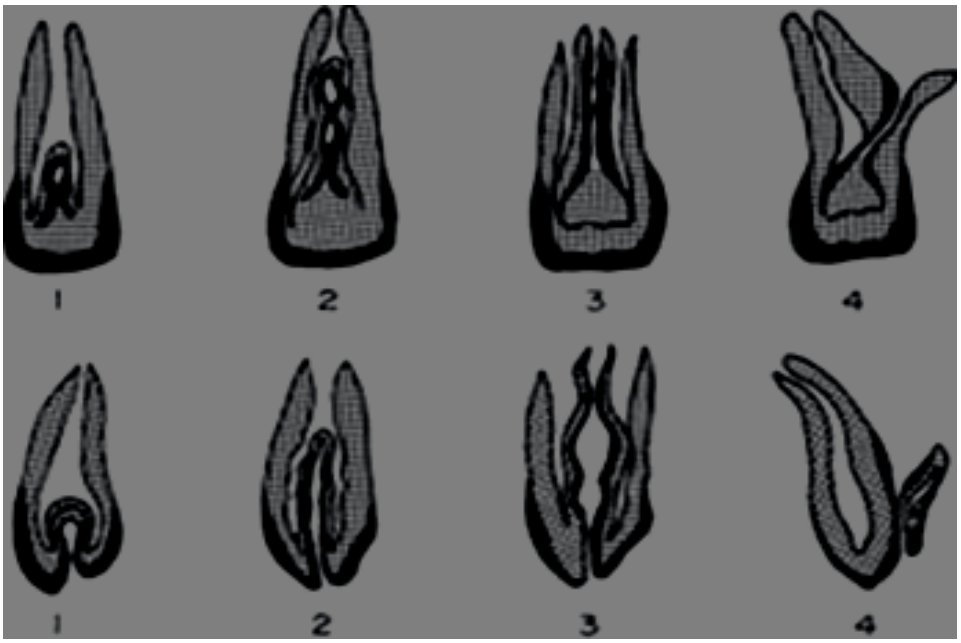


Figure 2: Classification of dens invaginatus according to Schulz and Brand [8].

1.3. Diagnostic methods

In most cases, this anomaly is found by chance while processing and x-ray image. An unusual morphology of the crown is present in the oral cavity, which either has an expanded, barrel-like or conical shape, or a deep foramen caecum /Figure 3/.

Because the anomaly most commonly affects the permanent maxillary lateral incisors, these should be examined thoroughly clinically and via x-ray. Conventional x-ray image cannot provide all the detailed information about the structure of the malformation. It is appropriate to use the latest x-ray technology for different types of root canals.

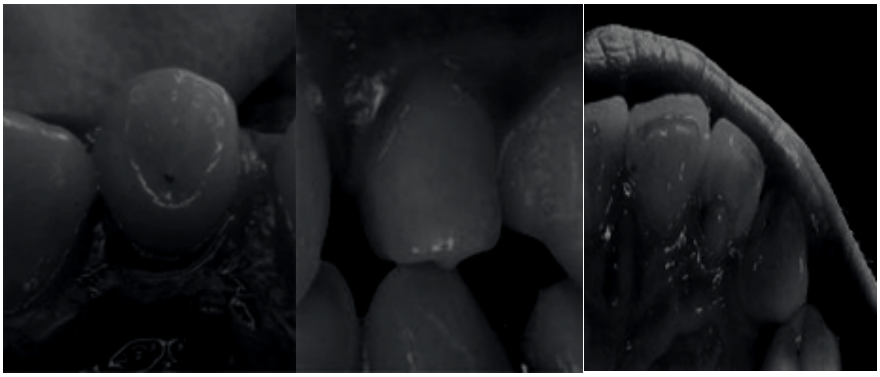


Figure 3: Dens invaginatus with conical crown and massive cingulum [4].

Clinical identification of an invagination may be difficult. Methylene blue can be used to locate root canal entrances /Figure 4/.

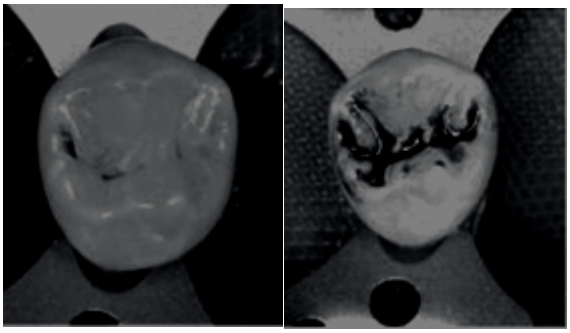


Figure 4: Methylene blue revealing the distal fissure color.

This tooth requires a root canal treatment, due to a secondary loss of vitality because of invagination [4].

Invagination represents a place of predisposed tooth decay due to thin dentin and enamel layers. In some cases, the enamel layer is incomplete and canals exist between the invagination and the pulp. Pulp necrosis often arises during the eruption, before the apex of the root has closed. Untreated coronary invagination results in abscesses, cysts, teeth shifts, internal resorption, facial cellulitis. Common occurrence of dens invaginatus cases are documented in literature, as well as teeth anomalies concerning their numbers or shapes, or syndromes like Williams, Apert, Crouzon, and many others [4].

TYPE I and TYPE II generally start as a narrow undilated fissure, which gradually extends and ends in the crown /TYPE I – figure 5/ or the root area /TYPE II – Figure 6/. If an invagination invades the coronal or the root area, the outer part of pulpal area may undergo a change that ultimately results in “dulling” of pulp horns. The defects can vary in size and shape. It can be pear-shaped or the x-ray can look like a tooth in a tooth. The edge of the invagination is neatly bordered with an opaque layer of enamel.

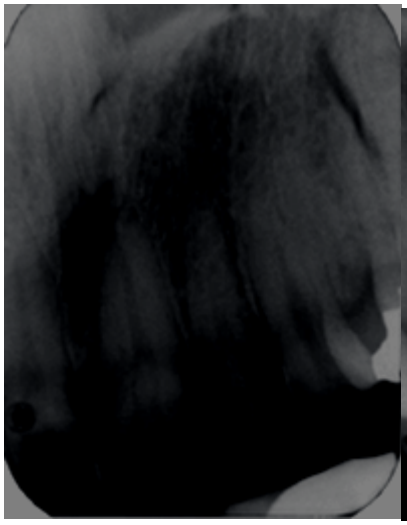


Figure 5: TYPE I Dens invaginatus

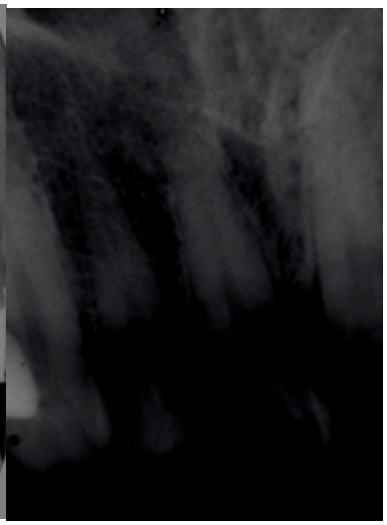


Figure 6: TYPE II Dens invaginatus

TYPE IIIA demonstrates itself as a deep tooth fissure that exists on a lateral surface of the root. Root canal adjacent to invagination can be curled and abnormal. Bacterial penetration into an invagination may result in periodontitis. In case the invagination is infected, the tooth will certainly lose vitality, as a result of complex communication between the invagination and root canals /Figure 7/.

TYPE IIIB is difficult to precisely localize and identify how it overlaps the root canal. The apical formation may manifest itself by not closing the apex and a periapical lesion may also be present in a number of cases /Figure 8/.

Figure 7: Type IIIA

Figure 8: Type IIIB

On the figure 9 is a axial CT scan of extracted tooth showing an invagination.

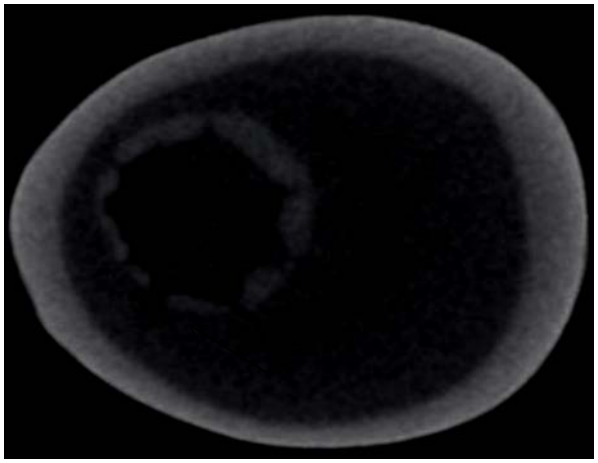
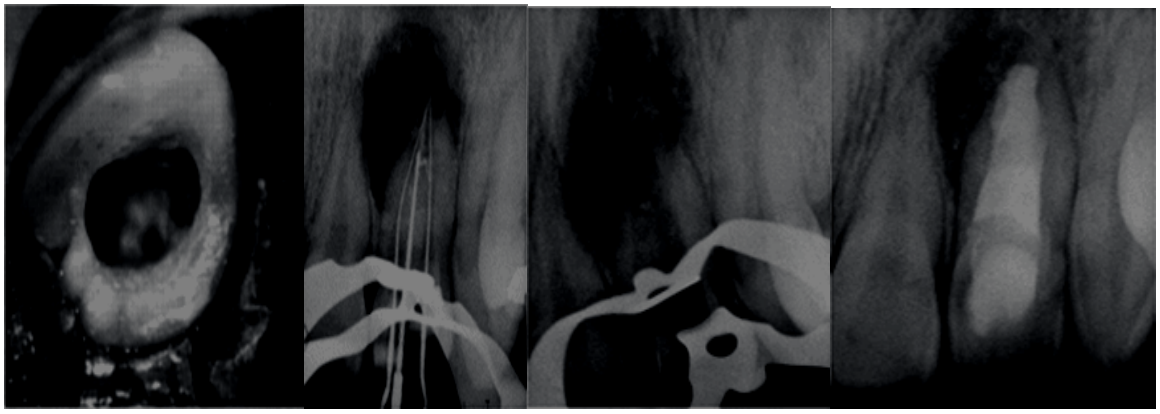


Figure 9: Axial CT scan of extracted tooth showing an invagination. Arrow shows the depressed pulp caused by the invagination. The invagination in the left with nine separate interruptions /thin grooves/ in the adamantine layer [2].

1.4. Therapy

Possible treatment options include prophylactic sealing of the invagination, endodontic therapy /Figure 10/, endodontic apical surgery, replantation, or extraction.



A B C D

Figure 10:

A. Access cavity for type III dens invaginatus (optional openings)

B. Designation of the length and the side grooves

C. RTG after the complete invagination removal

D. Sealing with MTA material and subsequent obturation with thermoplastic gutta-percha [4].

2. Case report

An 11-year-old female patient was sent on a maxillo-ortodontic examination for the purposed extraction therapy, because her tooth 23 has not erupted yet, after the gap between the teeth 22 and 24 had closed due to premature loss of primary tooth 63. No indication of problems or illnesses. Clinical examination found an anomalous shape and size of the left lateral incisor, therefore the patient was sent for an x-ray. The x-ray image detected an anomaly – dens invaginatus of the tooth 22 /Figure 11/.

Figure 11: X-ray image of 11-year-old female patient with a rare radicular form of dens invaginatus on tooth 22, which also hampers the eruption of tooth 23.

Clinically the invagination may either constitute a small indentation in the foramen caecum area or a sizeable expansion up to foramen apicale. In 1958, Oehlers [6] also described the radicular form of invagination. This type is rare and the affected tooth shows signs of root dilation.

The patient was recommended a surgical extraction of the abnormal tooth 22. After the extraction, tooth 23 spontaneously erupted in place of tooth 22. Tooth 23 was modified to look like tooth 22 for aesthetic reasons. No other therapy was needed.

Figures 12, 13, 14 shows a tooth with the rare radicular form of dens invaginatus after surgical extraction.

Figure 12: Tooth No 22 with radicular form of dens invaginatus after surgical exraction.

Figure 13: Tooth No 22 with radicular form of dens invaginatus after surgical exraction. The root of the tooth is wider than the crown.

Figure 14: Tooth No 22 with radicular form of dens invaginatus after surgical extraction. Gangrena of the pulp present after the separation of crown and root parts.

3. Discussion

Dens in dente is a dental anomaly that requires early diagnosis and intervention, and interferes with endodontic treatment. A deep lingual pit is often present on the tooth affected with dens invaginatus. The pit may be filled with soft tissue similar to dental follicles, the soft tissue becomes necrotic when the teeth erupt into the oral cavity. Permanent maxillary lateral incisors are the most commonly affected teeth followed by maxillary central incisors, premolars, canines and molars. The presence of dens in dente results in more difficult opening and shaping of root canals than in normal teeth [4]. It can pose as a challenge for the clinician as teeth with invagination are more susceptible to caries because of the presence of deep pits and structural defects. These defects have malformed enamel and fine canals leading to communication with the pulp. Microorganisms have easy access through such communication, thereby causing infection and necrosis of the pulp. Clinically, the presence of dens invaginatus can be detected by unusual crown morphology, however, in some cases, the tooth may show no clinical features of any abnormal structure and might appear otherwise normal. In such cases, the anomaly is detected incidentally on a radiograph taken for another indication.

Different treatment options are available and the correct choice depends on the morphology of the involved tooth and severity of infection. These include non-surgical endodontic treatment, combined endodontic and surgical treatment, intentional replantation, extraction and pulp revascularisation. Revascularisation of the pulp space in a necrotic infected tooth with apical periodontitis is considered to be impossible, according to Trope [10]. Moreover, it is a debatable procedure and has certain associated limitations such as absence of standard follow-up protocol, there have been long-term studies to assess outcomes such as the redevelopment of apical periodontitis and incidence of pulp canal obliteration. In open apex cases, the primary objective is to induce root formation by the use of chemicals, including calcium hydroxide pastes and mineral trioxide aggregate (MTA) barriers [9].

4. Recommendation

Dens in dente is a developmental anomaly that shows a wide range of the spectrum. The clinician should be aware of the presence of dens invaginatus as it has the potential of causing apical inflammatory disease. Treatment of dens in dente depends on the extent and severity of the lesion.

5. Conclusion

Thorough clinical and x-ray teeth examinations, of erupting permanent maxillary lateral incisors in particular, help recognize the anomaly. A tooth with such anomaly is more susceptible to tooth decay and its vitality is jeopardized, which depends on the invagination’s proximity to the pulp. Premature pulp necrosis or apical periodontitis are the main threats in such anomalies. Conventional endodontic therapy is, unfortunately, impossible for the most part.

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