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Endodontic treatment of dens invaginatus with periapical lesion

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ABSTRACT

Dens invaginatus or dens in dente represent anomaly of the developing tooth due to invagination of the enamel organ into the dental papilla. Dens invaginatus is usually diagnosed by standard radiological methods (RVG, OPG, and 3DCBCT). Clinical examination may reveal a mottled, dilated or conical shape of the crown. Endodontic treatment of dens invaginatus can be difficult and complex due to the deviated anatomy. This report describes the successful endodontic treatment of a maxillary lateral incisor that had dens invaginatus and a large periapical lesion. Clinical examination in a 30-year-old patient revealed an acute periapical abscess, and a dens invaginatus type II was diagnosed after radiography. Due to the existing anatomy, endodontic treatment of the main canal was performed through two access cavities, which enabled chemo-mechanical treatment and access to all parts of the root canal. The canal of the invaginated tooth was treated through the third access cavity.

Keywords: Dens invaginatus; dens in dente; endodontic treatment

INTRODUCTION

Dens invaginatus or dens in dente are an anomaly of the developing tooth due to invagination of the enamel organ into the dental papilla. The invagination occurs before calcification of the tissue. During mineralization of the hard tissue, the invaginated enamel organ forms a small tooth in the future pulp chamber. Invagination of enamel and dentin may extend deep into the pulp cavity and root, and sometimes it may extend to the root apex (1-4).

Radiographically, there is a radiopaque invagination that has the same density as the enamel and extends from the cingulum into the root canal (5). The incorporation of enamel into dentin creates a niche with organic material beneath the enamel surface. Therefore, bacteria from the oral cavity can enter and spread into these malformations, causing a caries lesion and consequently inflammation of the pulp. This anomaly is most common in permanent maxillary lateral incisors, then maxillary central incisors, premolars, canines, and less common in molars (6,7).

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This condition was first described in a whale tooth in 1794. Salter referred to it as "a tooth within a tooth" in 1855. Dens invaginatus in human teeth was first described in 1856 by a dentist named Socrates. Mühlreiter called this phenomenon "anomalous cavities in human teeth" in 1873. Various terms have been used to explain this malformation (e.g., "dens in dente" - Busch and "dilated composite odontoma" - Hunter). The term "dens invaginatus" is the most widely accepted, as it reflects the penetration of enamel into the dentin with the formation of a pocket and dead space. These lesions are of clinical significance because bacteria from the oral cavity can invade and spread into these malformations, leading to early caries, and consequent pulp death (6,8).

There are a number of theories that attempt to explain the etiology of dens invaginatus (infection, trauma, growth pressure on dental lamina during odontogenesis and consequent folding of the enamel, rapid proliferation of the inner enamel epithelium into the underlying dental papilla, etc.). The ultimate cause is still unknown. Some genetic factors may be responsible for dens invaginatus. There are certain growth molecules that are genetic and regulate the unfolding and development of the enamel organ. If they are absent or altered, the morphology of the future tooth may be affected. These lesions could also be affected by other genetic anomalies (9).

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The classification of dens invaginatus by Oehler (10) is the most commonly used. He divided these lesions into three categories:

Class I: Partial invagination confined to the crown of the tooth. The lesion involves dentin and enamel but does not extend over cement-enamel junction and does not involve the pulp.

Class II: Invagination extends beyond the tooth beyond cement-enamel junction into the root. The lesion may or may not involve the pulp, it remains within the root and there is no connection to the periodontal ligament.

Class IIIa: Invagination is complete and extends through the root. There is a connection to the periodontal ligament through a second foramen located laterally. Normally, the pulp is not affected, but the anatomical malformation is significant.

Class IIIb: The invagination is complete and extends over the entire root. There is a communication with periodontal ligament through the apical foramen. Normally, the pulp is not directly affected, but the tooth anatomy is significantly compromised.

The treatment protocol must be determined based on advanced imaging, three-dimensional (3D) if possible. Depending on the severity of the invasion, a wide range of treatment modalities is available, from placement of sealants to retrograde fillings. Successful endodontic treatment is achieved when a tooth has a predictable morphology that can be easily debrided by cleaning and shaping followed by 3D obturation. An atypical anatomy confirms the difficulty of endodontic treatment and the use of special instruments (11-13).

CASE REPORT

A 30-year-old male patient was admitted to the department of dental pathology because of swelling and pain in the area of the right maxillary lateral incisor. Clinical examination revealed an acute periapical abscess in the region of tooth 12. A large composite filling was found on the tooth, which the patient stated had been placed several years previously. The tooth was sensitive to percussion, and palpable swelling of the surrounding soft tissue showed no signs of fluctuation. Probing depths were within normal limits.

Digital retroalveolar imaging revealed the presence of dens invaginatus and a large periapical lesion (Figure 1). Based on these findings, the patient was diagnosed with dens invaginatus type II and chronic apical periodontitis that developed into an acute abscess in the last few days.

Conventional root canal treatment was indicated. Endodontic treatment was performed with a surgical microscope (Carl Zeiss OPMI Pico, Germany). The entrance to the invaginated tooth was located first, while the main canal was accessed from two sides (mesial and distal). The main canal was explored on both sides with a size 10K file and treated with a size 45 hand file (DentsplyMaillefer, Baillaigues, SWITZERLAND). The working length of the main canal was determined with an apex locator (Raypex 6, VDW GERMANY). The invaginated canal was very short, but it is treated in the same way as the main canal. The focus was on deep irrigation, 3D debridement, and disruption of the smear layer and biofilm with sodium hypochlorite (3% Ultradent USA) and EDTA (18% Ultradent, USA) activated by Endo Activator (Dentsply Tulsa Specialties, USA). NaviTip TM Tips (Ultradent, USA) with a length of 25 mm and a 29-gauge cannula were used for deep irrigation.

At the same visit, the canals were filled with non-setting calcium hydroxide UltraCal XS (Ultradent, USA) (Figure 2) and due to the presence of an abscess, the patient was prescribed an antibiotic Xiclav 1000 mg (combination of amoxicillin and clavulanic acid) every 12 h for the next 7 days (14).

Three weeks later, at the second visit, it was noted that the swelling had completely disappeared, the patient did not report pain or any other type of discomfort. The calcium hydroxide is removed from the root canal by extensive manual irrigation with sodium hypochlorite in combination with manual instrumentation and final irrigation with EDTA. The invaginated main root canal was obturated with AHPlus Siler (Dentsply DeTrey, Constance Germany) and gutta-percha using the cold lateral compaction technique. After obturation and 3 months later, an RVG control image was taken (Figure 3). The tooth was restored with Tetric EvoCeram Bulk Fill composite (Ivoclar, Liechtenstein) (Figure 4).

The patient gave written informed consent for the use of the data for the case report.

FIGURE 1. Pre-operative radiographic appearance of dens invaginatus (Type II) and large periapical lesion.

FIGURE 2. Radiograph of a tooth 3 weeks after treatment with calcium hydroxide.

DISCUSSION

Any of the teeth in the maxillary and mandibular arches may be affected by dens invaginatus, but the lateral incisors of the maxilla are most commonly affected (15-17). The incidence of this occurrence is 0.04–10% in the general population (18). Dens invaginatus may occur bilaterally or in more than two teeth (19).

In our case, dens invaginatus was located on the maxillary right lateral incisor; A form of dens invaginatus has also been observed on the adjacent canine, whereas the same teeth on the contralateral side were of ordinary morphology, without signs of this occurrence. The vitality tests of all adjacent teeth were in the normal range.

Dens invaginatus is usually diagnosed by standard radiological methods (RVG, OPG, 3DCBCT). Clinical examination may reveal a mottled, dilated, or conical shape of the crown (20). In our case, the patient had normal external morphology of the lateral incisor (Figure 5).

The anatomy and morphology of dens invaginatus can be extremely complicated, further complicating both the diagnostic procedures and the treatment itself. It is very important that the practitioner be familiar with the morphologic variations that can occur in dens invaginatus so that he or she can develop a diagnostic and treatment plan for successful endodontic procedures.

FIGURE 3. Postoperative radiograph, 3 months after obturation.

FIGURE 4. Maxillary lateral incisor before and after restoration.

FIGURE 5. External morphology of the maxillary lateral incisor affected by dens invaginatus.

Endodontic treatment of dens invaginatus is difficult and unpredictable, leaving bacterial residues and microorganisms that are difficult to remove by conventional methods.

This case report presents the endodontic treatment of a type 2 dens invaginatus in which the standard manual technique of root canal treatment with extensive irrigation was used. Although obturation by gutta-flow would have been more appropriate, lateral condensation was performed, which succeeded in obturating a very wide root canal, thanks to the access to the root canal from the mesial and distal sides. The RVG image taken after obturation also showed that a large periapical process had regressed. After endodontic treatment and placement of the final restoration, the patient is without clinical symptoms.

CONCLUSION

Dens invaginatus have a greater chance of developing periapical lesions. The treatment of such teeth requires a detailed analysis of the morphology and planning of the most appropriate treatment. To prevent the occurrence of pulp disease and complex endodontic treatment, early detection of dens invaginatus and implementation of appropriate preventive measures is extremely important.

DECLARATION OF INTEREST

The authors declare no conflict of interest.

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