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Non-surgical endodontic treatment of a maxillary lateral incisor with dens invaginatus: A case report

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Key words *dens invaginatus type III, "dens in dente", endodontic treatment, maxillary lateral incisor*

Aim: Dens invaginatus is a malformation of the teeth, probably resulting from an infolding of the dental papilla during tooth development. The maxillary lateral incisor is the most commonly affected tooth, though not necessarily the only one. This case report shows a successful root canal treatment of a maxillary lateral incisor with this anomaly and an associated periradicular radiolucent lesion.
Methods: A 12-year-old male patient with severe pain and facial swelling was referred by his general dentist for root canal treatment of the left maxillary lateral incisor. After clinical and radiographic examinations, the diagnosis resulted in an acute alveolar abscess with a periapical lesion. Radiographic examination revealed an aberrant tooth anatomy.
Results: The symptoms disappeared a few days after root canal treatment was carried out and the patient's recovery was satisfactory. Regular clinical and radiographic monitoring over the following years demonstrated complete healing of the periradicular lesion.
Conclusions: Accurate diagnosis of dens invaginatus led the clinician to clean, shape and fill this complex root canal system properly in order to achieve satisfactory periradicular healing without surgical intervention. Results are supported by 5 years of follow-up examination reviews.

Introduction

Dens invaginatus is caused by an anomalous tooth development during morphodifferentiation. It is evident that more than one factor may be responsible for the development of a dental invagination. It is also referred to as "dens in dente", dens telescope, dilated composite odontome and gestant anomaly[1]. The variation in nomenclature is reflected in the different theories about its aetiology. The malformation is estimated to affect between 0.04% and 10% of people[1-2]. The permanent lateral maxillary incisor is the most commonly affected (around 43% of all cases), but malformation may occur in any teeth anywhere in the jaws. A bilateral occurrence is also frequently seen[1-2].

Three forms of dens invaginatus have been described by Oehlers[3-4], depending on the depth of the invagination. In Type I, the invagination is minimal and enamel-lined; it is confined within the crown of the tooth and does not extend beyond the level of the external cementoenamel junction. In Type II, the invagination is enamel-lined and extends into the pulp chamber but remains within the root canal with no communication with the periodontal ligament. Type III is sub-divided into two groups[5]: Type IIIA, in which the invagination extends through the root and communicates laterally with the periodontal ligament space through a pseudo-foramen. There is usually no communication with the pulp, which lies compressed within the root. In Type IIIB, the invagination extends through the root and communicates

with the periodontal ligament at the apical foramen. There is usually no communication with the pulp.

The clinical morphology of the crown may range from normal to presenting an unusual form, depending on the size of the invagination. In 1957, Oehlers[4] also described different crown forms: normal with a deep lingual or palatal pit; conical, barrel-shaped or peg-shaped with an incisal pit, relating to the three groups mentioned. Radiographic examination shows a radio-opaque invagination, equal to enamel in density, extending from the cingulum to a varying distance into the root. The defects may vary in size and shape from a loop-like, pear-shaped or slightly radiolucent structure, to a severe form resembling a "tooth within a tooth". In general, the radiographic evaluation shows a periapical lesion in conjunction with the affected tooth[1-4]. In order to reach an accurate diagnosis, the analysis process should involve periapical radiographs, cone beam computed tomography (CBCT)[6-7] and the clinician's expertise of this complex system of root canals. A misdiagnosis might lead to inappropriate treatment.

The objective of the treatment is to achieve healing and retention of the affected tooth. In cases in which no pathology is diagnosed, a plan for prevention and control should be appropriate. If there are no signs of pulp pathology and no communication between the invagination and the root canal, root canal treatment or, in minor cases, even a composite or amalgam filling of the invagination would be adequate. When the invagination has a separate apical or lateral foramen, root canal treatment of the invagination is indicated. When pulpal or periapical pathology develops, the most likely treatments are either root canal therapy – with or without endodontic surgery – or extraction, as the last choice[1,8-9].

This case report presents a successful nonsurgical root canal treatment of a maxillary lateral incisor with acute alveolar abscess; dens invaginatus type III (b), and an associated large periradicular lesion.

Case report

A 12-year-old male patient with severe pain and facial swelling was referred by his general dentist for root canal treatment of the left maxillary lateral incisor. A partial coronal access to the pulp tissue was performed by the referring dentist for pain reduction 2 days before. The patient had also been prescribed antibiotics (Amoxicillin 500 mg, each 8 h) for 7 days. On his first visit, clinical and radiographic examination confirmed the aching tooth was the tooth 22, as indicated by the general dentist. Radiographic examination (Fig 1) suggested the following possibilities: (a) "dens in dente", (b) a large diffuse apical and lateral root lesion; and (c) more than one root canal. The radiolucent lesion was of endodontic origin, as confirmed by a negative pulp testing.

As an acute alveolar abscess was diagnosed, root canal therapy was the first choice of treatment. After local anaesthesia and rubber dam isolation, the access preparation was completed and two root canal orifices were identified: one mesial and one distal (Fig 2). Pus drainage was established and both canals were irrigated with 2.5% sodium hypochlorite (NaOCl). After 10 mins, drainage stopped and the canals were explored with ISO-sized 15 K-files (Dentsply Maillefer, Ballaigues, Switzerland) and then flared using Gates Glidden drills (Dentsply Maillefer) sizes 2 and 3. Working length was determined using an apex locator (Root ZX, J. Morita, Tokyo, Japan) and a radiograph was taken with size 30 K-files inserted into the canals to confirm the working lengths radiographically (Fig 3). Root canals were enlarged with stainless steel K-files (Dentsply Maillefer) used according to the balanced-force technique. The mesial canal was prepared to a size 80 master apical file (MAF) and the distal canal to a size 70 MAF. During biomechanical preparation, the canals were irrigated with 2.5% NaOCl. The last irrigation combined 17% EDTAC (Farmadental, Buenos Aires, Argentina) for 2 mins and was followed by 2.5% NaOCl. Finally, the canals were dried with sterile paper points and dressed with a calcium hydroxide paste (Farmadental) for 14 days. The access cavity was sealed with Cavit G (3M Espe, Seefeld, Germany) and IRM (Zoer's, Argentina) between visits to prevent contamination of the canals. Systemic analgesics were prescribed (Ibuprofen 400 mg every 8 h) for 2 days and the antibiotic treatment was continued for the next 5 days to complete it adequately.

Then 2 weeks later, following local anaesthesia and tooth isolation, the calcium hydroxide dressing was removed using K-files and 2.5% NaOCl

Fig 1 Diagnostic radiograph of the left maxillary lateral incisor showing dens invaginatus type III, associated with a large periradicular lesion.

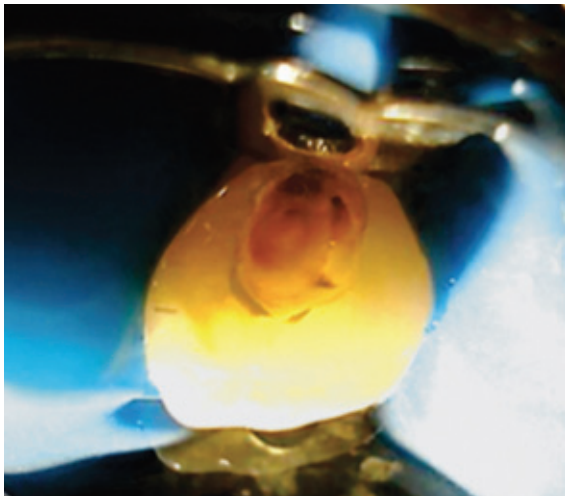

Fig 2 Access cavity with two canal orifices (mesial and distal).

Fig 3 Working length radiograph.

irrigation. Before obturation, both canals were irrigated with 17% EDTAC and 2.5% NaOCl and dried with sterile paper points (Meta Biomed, Chungbuk, Korea). Canals were then filled with gutta-percha points (Dentsply Brasil, Petropolis, Brazil) and Grossman Sealer (Farmadental) according to the cold lateral condensation technique (Fig 4). The access cavity was temporarily sealed with Cavit G (3M Espe) and intermediate restorative material (IRM) (Zoer's). The patient was instructed to return to the general dentist for the permanent coronal restoration.

During the daily post-treatment controls, the patient reported a constant progressive remission of pain and symptoms. The 3-month recall radiograph (Fig 5) suggested partial periapical repair. Unfortunately, a separated instrument was recognised in the coronal portion of the mesial canal. The patient's mother mentioned that file separation occurred while his general dentist was removing the coronal portion of root canal filling to insert an intra-radicular post. After this mishap, the post insertion procedure was not completed and, instead, the general dentist filled the access cavity with resin composite as the definitive restoration.

The 24-month control radiography showed complete healing of the periradicular lesion (Fig 6). On another follow-up radiograph 5 years later (Fig 7), normal clinical conditions were observed and the periapical appearance was considered healthy.

Fig 4 Postoperative radiograph after root canal filling.

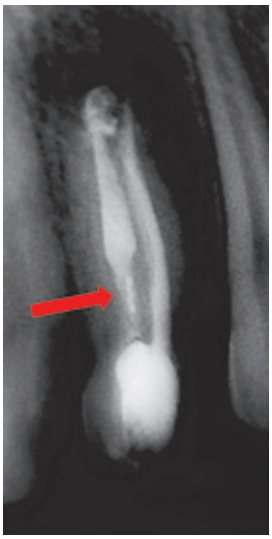

Fig 5 At 3-month radiographic follow-up, showing partial bone regeneration and a separated instrument in the mesial canal.

Discussion

Root canal treatment in teeth with dens invaginatus, extending up to the apical region and associated with periradicular radiolucency, generally involves complicated procedures that include accurate diagnosis and appropriate treatment planning. There is a high incidence of pulp infection and degeneration associated with this anomaly. This is the reason why

Fig 6 A 24-month recall radiograph showing periradicular healing.

Fig 7 A 5-year recall radiograph demonstrating satisfactory bone healing.

Oehlers in 1957[3] and 1958[4] emphasised the importance of early diagnosis to prevent pulp necrosis and periapical inflammation. The diagnosis of dens invaginatus is generally based on a clinician's knowledge and periapical radiographs. However, nowadays it would be highly recommended that CBCT[6-7] should be incorporated into the diagnosis process[10].

When root canal treatment is indicated, a careful analysis of the configuration of the root canal system is essential for treatment planning. The complexity of the canal system in dens invaginatus Type III, presents a challenge to root canal treatment[11]. Furthermore, the morphology of the main canal may be irregular, circular and/or narrow. A possible explanation is that the invaginated tissue occupied and compressed the main canal at different levels[1,12]. As observed in the present case, pulp necrosis and acute periradicular abscess with associated radiolucent lesion(s) are frequently found in cases of dens invaginatus[1-5,10].

The large and irregular volume of the root canal system makes proper shaping and cleaning difficult. Independent of whether manual or rotary instrumentation techniques were used, agitation of the irrigant is of utmost importance to clean the complex canal system. Agitation of the irrigant can be performed by sonic or ultrasonic devices, such as the EndoActivator (Dentsply Maillefer). However, ultrasonic activation of the irrigant using special devices with specific tips might be more efficient to reach and clean this complex canal morphology than sonic activation. Irrigation should include NaOCl solutions from 2.5% to 5.25% or even 6%, and a final irrigation with 17% EDTAC and NaOCl is recommended in order to remove the smear layer produced during instrumentation[11,13-14].

For the root canal filling of such teeth, warm gutta-percha techniques including warm vertical compaction or other techniques based on thermoplasticised gutta-percha may be useful[13,15], but the extrusion of materials beyond the apex occurs frequently. However, even the cold lateral condensation technique has been reported to lead to successful results[11].

Instrument separation occurred while the general practitioner was removing the coronal gutta-percha from the mesial canal to introduce an intraradicular post. File breakage occurred 2 weeks after completion of the root canal treatment but was identified in the 3-month follow-up periapical radiograph. The condition was assessed and it was considered that there was no risk associated with the fractured instrument, because the fragment was located far away from the apical third of the canal and the filling material above the fragment was adequately compacted. Nevertheless, this was re-evaluated in every examination and no complications arose during the 5 years of follow-up appointments.

The treatment of a tooth with Type III dens invaginatus is usually complicated. Nonsurgical root canal treatment should be attempted first, irrespective of the size of the periradicular lesion[1,5,9]. Surgical treatment is the second option. In this case, root canal treatment was sufficient to obtain periapical bone reparation. Periapical surgery is indicated for cases in which conventional root canal therapy has failed[8]. A complementary surgical procedure should be recommended for teeth that present anatomic variations, which do not allow access to all parts of the canal system for cleaning. This applies to many cases of dens invaginatus type III with periapical lesions[8,14].

All radiographs over the 5-year follow-up period showed a possible non-instrumented root canal in the mesial part of the tooth. It should be mentioned that this canal was not located, cleaned and shaped, but nevertheless the treatment was successful. There

is the possibility it was an isolated canal with no communication to the infected part of the tooth's root canal system. As sensibility testing was not positive, this canal might be occupied by necrotic or calcified pulp tissue.

Conclusions

This type of dental malformation requires an accurate diagnosis, not only because of the complexity of the internal anatomy, but also due to the associated pathologies. Diagnosis should be followed by an exhaustive chemo-mechanical procedure, to access, clean, shape and fill the root canal system properly. Despite the complex anatomy of dens invaginatus type III (b), nonsurgical root canal treatment was conducted successfully. Follow-up examinations after 5 years showed that periapical healing had been achieved and further surgical intervention was not necessary.

Acknowledgements

The author thanks Dr Fernando Goldberg, Professor and Director of the Department of Endodontics at the School of Dentistry, University of Salvador / Asociación Odontológica Argentina (U.S.A.L. / A.O.A.), Buenos Aires, Argentina, and Dra Arminia Baroffi, Professor and Director of Clinical Endodontics at Círculo Odontológico de Rosario, Rosario, Argentina for providing valuable comments on the article and on-going advice during his career.

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