Endodontic and aesthetic management of a conoid tooth with type IIIA dens invaginatus



J. Bahillo*, M. Freire**,
B. Martin-Biedma***, P. Castelo-Baz***

Master of Science in Advanced Endodontics and Restorative Dentistry ENDORE, School of Dentistry, University of Santiago de Compostela, Spain
**DDS, MsC, PhD, Clinical Professor*
***DDS, MsC, Clinical Professor*
****DDs, MsC, PhD. Director and Clinical Professor*

e-mail: jbahillovarela@gmail.com

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Abstract

Background Dens invaginatus is a dental developmental abnormality caused by an infolding of the enamel organ into the adjacent dental papilla before the calcification of the dental tissues. The clinical presentation of dens invaginatus varies according to its severity, from mild forms, in which we might find a deeper than normal cingulum pit, to severe cases, in which there is a pronounced infolding reaching the apical foramen. The very nature of the invagination favours the contamination from the oral environment to the pulp space and the onset of caries. Therefore, patients might present with symptoms or signs of pulpitis and/or apical periodontitis. The aim of this paper is to present the successful endodontic and restorative management of a conoid shaped upper lateral incisor, affected by dens invaginatus type IIIA.

Case report A 13-year-old girl was referred to our office for endodontic and aesthetic treatment of the right upper lateral incisor, which was asymptomatic. Clinical, radiographic and photographic examinations were performed. The diagnosis of this tooth was dens invaginatus, Oehlers type IIIA with chronic apical periodontitis. Full isolation and magnification were used to achieve correct endodontic management of the aberrant internal anatomy of the tooth. Ultrasonic tips and a combination of manual and mechanical instruments were used for cleaning and shaping. Warm vertical condensation technique was used for sealing the canal system. As the final restoration it was chosen an indirect composite crown bonded to the tooth surface with minor preparation and using an adhesive technique. Radiographic healing and satisfaction of the aesthetic needs was achieved up to 5 years from completion of treatment.

Conclusion This case report shows the successful outcomes of a complex case based on proper diagnosis and correct treatment strategies for arresting the progression of apical periodontitis in challenging internal anatomies, as well as the fulfillment of a young patient aesthetic needs.

KEYWORDS Dens invaginatus; Apical periodontitis; Indirect composite restoration; Conoid tooth.

Introduction

Dens invaginatus is a dental developmental abnormality caused by an infolding of the enamel organ into the adjacent dental papilla before the calcification of the dental tissues. It starts at the crown and sometimes it extends to the root of the tooth Hüllsmann, 1997]. Several causes explaining the incidence of dens invaginatus have been exposed [Alani and Bishop, 2008], being the most accepted genetic aetiology, and the tooth most affected by this anomaly is the upper lateral incisor [Hüllsmann, 1997; Alani and Bishop, 2008].

The clinical presentation of dens invaginatus varies according to its severity, from mild forms, in which we might find a deeper than normal cingulum pit, to severe cases, in which there is a pronounced infolding reaching the apical foramen [Alani and Bishop, 2008; Patel, 2010]. The very nature of the invagination favours the contamination from the oral environment to the pulp space and the onset of caries. Therefore, patients might present with symptoms or signs of pulpitis and/or apical periodontitis [Patel, 2010].

Oehlers's [1957] classification is still the most used to date [Keles and Cakici, 2010]. According to the clinical presentation and degree of root involvement of the dens invaginatus, three types are described: in type I, the invagination is confined to the crown, while in type II the invagination is enamel-lined and invades the radicular space but remains closed in a blind sac, sometimes in communication with the main canal; type III extends from the crown to the root and communicates with the periodontium through a lateral pseudoforamen (type IIIA) or through the foramen of the main canal (IIIB) [Patel, 2010; Oehlers, 1957; Keles and Cakici, 2010].

The purpose of this article is to present a case of an upper lateral incisor, conoid-shaped, affected by dens invaginatus type IIIA, managed with a non-surgical endodontic and restorative treatment.

Case report

A healthy 13-year-old girl was referred for endodontic and aesthetic treatment of the right upper lateral incisor, which



FIG. 1A Baseline extraoral view of a 13-year-old girl who presented an upper right lateral conoid-shaped incisor. B-C Conventional x-ray and CBCT images showing the anomal anatomy, matching to Oehlers type IIIA dens invaginatus.

was asymptomatic. Clinical, radiographic and photographic examinations were performed (Fig. 1A).

The conoid tooth was clinically normal to probing but did not respond to the thermal test (Endo Ice, Coltene Whaldent Inc). A periapical radiograph revealed an abnormal canal anatomy and also a radiolucency surrounding the apical area. A CBCT scan was obtained for better assessment of the complexity of the canal configuration (Fig. 1B-C).

The established diagnosis was "dens invaginatus, Oehlers type IIIA with chronic apical periodontitis".

Under full isolation and magnification with operating microscope, the invagination was fully removed up to the middle third of the root using an ultrasonic tip (Start X No. 3, Dentsply Sirona, ET25, Satelec) and preparation of the canal system was completed with both manual and mechanical instrumentation (Protaper Next, Dentsply Sirona) up to X4 and up to X2. Irrigation was performed with a 30-G needle (ProRinse; Dentsply Tulsa Dental Specialties, Tulsa, OK) using 3 mL of 5% NaOCl after each filing. The irrigation needles were introduced passively up to 2 mm from the working length, and the rate of delivery was fixed at 3 mL/min. After instrumentation, all teeth were rinsed for 3 minutes with 3 mL 17% EDTA (Canal Pro, Coltene Whaledent, Altstätten, Switzerland) followed by a 3-minute final rinse with 5% NaOCl. Ultrasonic activation was performed with an ISO15 ESI file (EMS, Nyon, Switzerland) mounted on an ultrasonic unit. The file was passively inserted to 1 mm from the working length and activated using a power setting of 4, as recommended by the manufacturer. The canal system was filled using gutta-percha in combination with endodontic resin sealer AH Plus (Dentsply, DeTray, Konstanz, Germany) (Fig. 2) using the continuous wave of condensation technique (Elements System, Sybron Endo). After one-month follow-up, the aesthetic restoration was considered.

An indirect composite crown was chosen as the final restoration. Minor tooth preparation was necessary in order to create a correct path of insertion.

Conditioning of the restoration surface was performed following this protocol

- Airborne-particle abrasion (CoJet, 3M ESPE).
- Abundantly rinsing and drying.
- Organic silane (60 seconds).
- Drying with oil-free compressed air.
- Light-curing bonding resin (XP Bond, Dentsply, Sirona) application without procuring.

Conditioning of the cavity was performed by the following steps:

- Gently cleaning with 30 µm Al3O2 particles.
- Etching with 37.5% orthophosphoric acid gel.
- Active application (15 seconds in scrubbing motion) of XP Bond adhesive (Dentsply Sirona).

Then, a sufficient amount of heated microhybrid composite was applied to the inner surface of the restoration and set in place. Full polymerisation was achieved by light curing for 60 seconds per irradiated surface. Finally, the rubber dam was removed, and the occlusion was checked and corrected. (Fig. 3)

At the 5-year follow-up, the apical periodontitis has healed, and the patient feels satisfied with the aesthetic appearance of the restoration (Fig 4).



FIG. 2A Periapical radiographic endodontic sequence with the postoperative situation. B. 5-year follow-up radiograph showing healing.

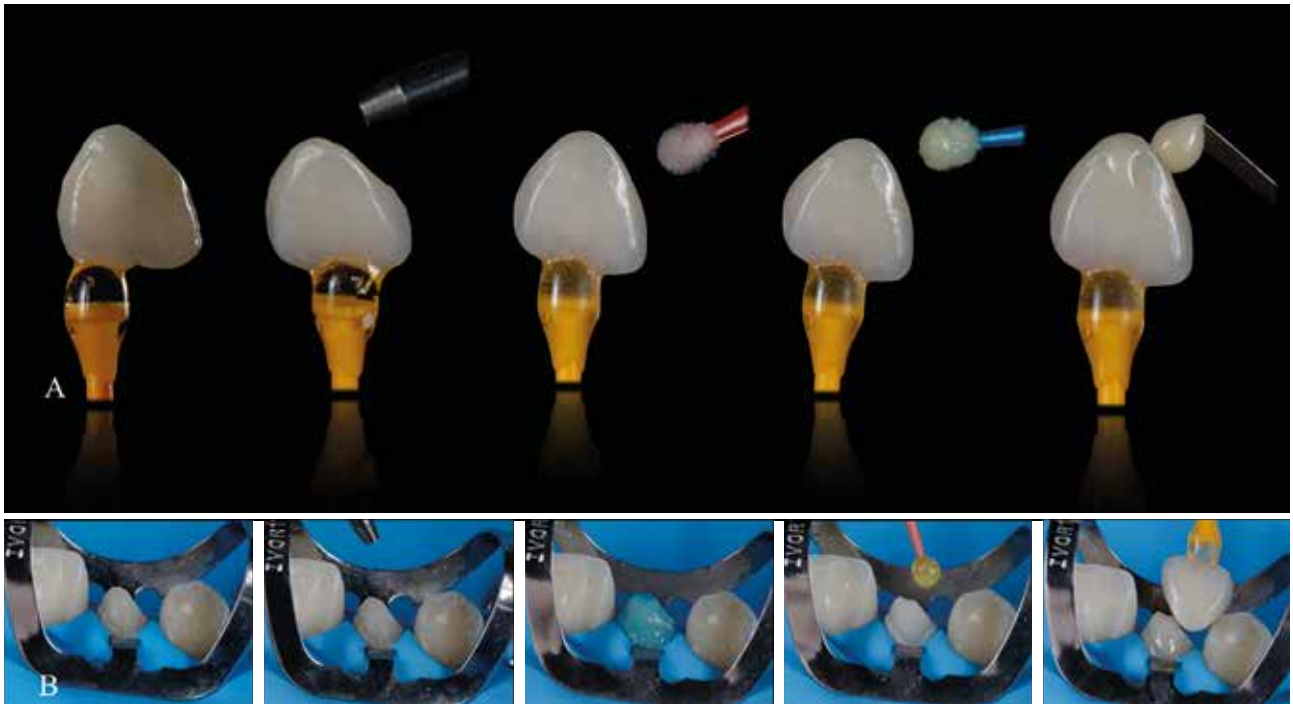


FIG. 3A Intraoperative sequential adhesive protocol on the restoration. B. Adhesive treatment of the surface of the tooth and seating of the workpiece.

Discussion

In the case described above, the cause of apical periodontitis seems to be the very nature of the entity "dens invaginatus", which predisposes the teeth that suffer it to an increased risk of developing pulpal pathology, even without evidence of caries or traumatism [Alani and Bishop, 2008].

Although it was not clinically possible to verify the existence of a communication between the invagination and the oral environment, it must have occurred because the tooth developed an apical periodontitis secondary to pulpar necrosis, probably due to bacterial contamination [Keles and Cakici, 2010].

The incidence of this entity has been described in teeth with morphological anomalies such as the one we described above, which shows a conical shape; but also in others, such as an incisal notch associated to a vestibular groove, presence of a palatal notch, cylindrical shape, enlarged mesiodistal or buccolingual ("dilated crown"), a "peg-shaped" cusp or a "talon cusp" [Zhu et al., 2017; Bishop and Alani, 2008].

Several authors have stated that the endodontic treatment of the main canal is not necessary if it does not communicate with the invaginated canal or if pulpal necrosis is not diagnosed [Zhu et al., 2017; Bishop and Alani, 2008; Vier-Pelisser et al., 2012]. In this case, the vitality tests performed were clearly negative and the apical periodontitis was associated with a main canal with a double foramen that presented this tooth, classified as dens invaginatus type IIIA. This is the reason why we considered both foramen as necrotic in the absence of signs of residual or delayed vitality that could still be present. This justified our decision of completely removing the invagination by using ultrasonic tips (Start X No. 3, Dentsply Sirona, ET25, Satelec) and under magnification with operating microscopy. This treatment option, although less conservative, has been documented with satisfactory results in literature in those cases in which both canals are necrotic [Zhu et al., 2017; Bishop and Alani, 2008; Silberman et al., 2006; Grinch and McClammy, 2002].



FIG. 4 Extraoral situation of the front teeth at the 5-year follow-up showing a successfully biological, functional and aesthetic integration.

It is essential to avoid perforation and separation of instruments during the negotiation of the invaginated canal, which has an aberrant anatomy and is enamel-lined on its internal walls. This increases the risk of fracture of rotating instruments, which are not recommended in these cases by several authors in favour of ultrasonic tips and manual files, which offer the clinician better tactile control [Zhu et al., 2017; Keles and Cakici, 2010; Patel, 2010].

Vertical condensation (continuous wave of heat) was the

obturation technique chosen in this case. Gauging of the canal obtained after joining the main canal and the invagination was 40, so we considered thermoplastified gutta-percha to be an appropriate material for apical sealing [Bishop and Alani, 2008].

Sometimes the shape or size of the apex does not meet the requirements for a conventional endodontic sealing, most commonly when joining of the invagination to the main canal is performed. At these situations, MTA is considered the material of choice. The use of MTA in combination with gutta-percha can be considered in wide apical portions with confusing morphology [Silberman et al., 2006; Munir et al., 2011].

Orthograde endodontic treatment should be the first choice followed by periapical surgery, intentional replantation (it has been documented in very complex forms of dens invaginatus type II and III) and extraction in case of consecutive therapeutic failure [Munir et al., 2011].

As for the restorative phase, the choice of a complete coverage composite crown was motivated by the age of the patient and the extent of dental tissue to be reproduced.

Using an adhesive technique and a minimal tooth preparation, a composite crown is a very conservative treatment option which allows future modifications in shape and size. In addition, it offers higher medium-term aesthetic results than a direct composite restoration. The latter would be less predictable given the large amount of dental tissue to be replaced in a 13-year-old patient, with a considerable aesthetic demand and a broad spectrum of optical effects to be mimicked. In addition, at the time of the treatment the patient presented Altered Passive Eruption (APE). This means that the restoration will have to be reevaluated when the occlusion is stable or when the APE is treated if not spontaneously solved when the eruption process finishes.

In Altered Passive Eruption, the apical displacement of the gingival tissues during the dental eruption does not occur completely. The CEJ is at the same level or below the bone and soft tissues cover the 19% or more of the clinical crown [Ahmad, 2017] resulting in square and short clinical crowns, gingival exposure greater than 2–3 mm and scalloped flat papillae [Alpiste-Illueca, 2011].

The eruption of the front teeth ends at the end of adolescence. Until this time, excess gum covering the buccal face of teeth is a rather common finding because eruption has not yet been completed [Munir et al., 2011]. This motivates the choice of an indirect composite restoration. Unlike ceramic restorations, composite allows further modifications or replacement.

Conclusion

This case report shows the successful outcomes of a complex case based on a proper diagnosis followed by correct treatment strategies for arresting the progression of apical periodontitis and for the fulfillment of the patient's aesthetic needs.

The use of advanced techniques in complex endodontic cases allows the achievement of an efficient apical seal and long-term maintenance of the affected tooth. Also, the choice of an indirect resin restoration with minimal preparation allows both proper resistance when a great amount of hard tissue has to be reproduced and the reassessment of the esthetic issue when eruption is completed, by modification or replacement of the current restoration.

Further studies and long-term data are required to corroborate these findings and verify the performance of these techniques.

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Authors' contributions

JB, MF and PC treated and documented this case report.

Declarations of interest

We certify that the authors have no conflict of interest to declare.

References

› Ahmad I. Altered passive eruption (APE) and active secondary eruption (ASE): differential diagnosis and management. Int J Esthet Dent. 2017;12:352-376.
› Alani A, Bishop K. Dens invaginatus. Part 1: classification, prevalence and aetiology. Int Endod J 2008;41:1123-36.
› Alpiste-Illueca F. Altered passive eruption (APE): a little-known clinical situation. Med Oral Patol Oral Cir Bucal. 2011;1:100-4.
› Bishop K, Alani A. Dens invaginatus. Part 2: clinical, radiographic features and management options. Int Endod J 2008;41:1137–1154.
› Grinch WJ, McClammy TV. Microscopic removal of dens invaginatus. J Endod 2002;28:336-9
› Hüllsmann M. Dens invaginatus: aetiology, classification, prevalence, diagnosis, and treatment considerations. Int Endod J 1997;30:79–
› Keles¸ A, Cakici F. Endodontic treatment of a maxillary lateral incisor with vital pulp. Periradicular lesion and type III dens invaginatus: a case report. Int Endod J 2010;43:608–14.
› Munir B, Tirmazi SM, Majeed HA, Khan AM; Iqbalbangash N. Dens invaginatus: aetiology, classification, prevalence, diagnosis and treatment considerations. Pak Oral Dental J 2011; 31:371-73
› Oehlers FA. Dens invaginatus. I. Variations of the invagination process and associated anterior crown forms. Oral Surg Oral Med Oral Pathol Oral Radiol 1957;10:1204–18.
› Patel S. The use of cone beam computed tomography in the conservative management of dens invaginatus: a case report. Int Endod J 2010;43:707–13.
› Silberman A, Cohenca N, Simon JH. Anatomical redesign for the treatment of dens invaginatus type III with open apexes: a literature review and case presentation. J Am Dent Assoc 2006;137:180–5.
› Vier-Pelisser FV, Pelisser A, Recuero LC, et al. Use of cone beam computed tomography in the diagnosis, planning and follow up of a type III dens invaginatus case. Int Endod J 2012;45:198–208.
› Zhu J, Wang X, Fang Y, Von der Hoff JW, Meng L. An update on the diagnosis and treatment of dens invaginatus. Aust Dent J. 2017;62:261-275.