Endodontic and surgical treatment in type III dens invaginatus: a 3-year follow-up with CBCT

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ABSTRACT

Introduction: The defect in the morphology of dens invaginatus causes the lack of blood supply to the pulp and consequent dental pulp necrosis, culminating in periapical lesion. Intervention with paraendodontic surgery is usual in these cases when conservative root canal treatment is unsuccessful due the complex anatomy and inaccessibility of the pulp tissue. This case reports the successful surgical root canal treatment evidenced by Cone-Beam Computed Tomography in dens in dente (type III) with considerable periapical lesion. Endodontic treatment was performed in a single session, followed by apicoectomy and retropreparation of the cavity with aid of an operating microscope and use of ultrasonic tips and retrograde obturation with Mineral Trioxide Aggregate. Lyophilized bovine bone and collagen membrane were inserted to fill the cavity. After 3-year follow-up, periapical radiographs, Cone-Beam Computed Tomography and 3D reconstruction were performed, showing favorable results as regards repair of the lesion.

Keywords: Cone-Beam Computed Tomography. Dens in dente. Periapical abscess. Root canal therapy. Microsurgery.

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Introduction

Dens invaginatus is a developmental anomaly that affects the shape of teeth by invagination into the surface of the crown before calcification. It is a relatively uncommon condition that affected teeth are more vulnerable to caries, pulp necrosis and infection of periradicular tissues with difficult access to the root canal. Its morphology varies from an apparently normal tooth with indiscernible invagination to the appearance of a "tooth within a tooth" (dens in dente). Depending on the degree of involvement, it remains unerupted or unnoticed until an infection occurs. In Type I, invagination of the enamel is circumscribed in the area of the tooth crown; in Type II, invagination exceeds the amelocement junction, extends up to the root and terminates in a blind sack; in Type III, invagination attains the apical region of the tooth and forms an additional apical or lateral foramen.[1-5]

Its prevalence varies from 0.3% to 10% of the teeth. Types I and II appear more frequently. The maxillary lateral incisor is the tooth most affected and it is rare in mandibular teeth. The premolars are more affected than canines, but less frequently than the central incisors. Posterior and primary teeth are hardly ever affected. There are reports of primary teeth that had to be carefully examined and promptly treated, because delayed intervention may cause complications. Generally, men are more affected than women in a ratio of 2:1. The anomaly varies in different ethnic groups, with the Chinese being more affected. There is conflicting evidence about whether the case is generally unilateral or bilateral.[3,6]

Clinical treatment includes different maneuvers, ranging from the simplest through to tooth extraction. Various techniques and approaches to treatment have been reported, such as the application of sealant of fossulas and fissures for physical protection from invagination; restorative treatment in the presence of carious tissue without pulp exposure and endodontic treatment with ultrasound inserts to remove the calcifications, with or without apicoectomy associated with retrograde obturation.[6,7,8]

Radiography is important in the diagnosis and assessment of the irregular morphology of the root canal system, but conventional radiography provides only a two-dimensional representation of the complex anatomy.[5,9,10] Cone-beam computed tomography (CBCT) is a recent addition to the dentist's armamentarium and has demonstrated efficacy in a large number of endodontic applications, including complex dental anatomy. Images are reconstructed using lower radiation doses compared with the conventional computed tomography. Provides three-dimensional (3D) undistorted images of the maxillofacial skeleton, including the teeth and their surrounding tissues.[5,9,11,12]

This case reports the successful surgical root canal treatment evidenced by cone-beam computed tomography 3-year follow-up in a dens in dente (type III) with a considerable periapical lesion.

Case report

The 23-year-old patient with intense pain and tumefaction in the palate, was referred for endodontic treatment of the maxillary right lateral incisor. The tooth was healthy, without caries and change in color and shape, without history of traumas or accidents and negative vitality tests.

The initial radiographic exam (Fig 1) revealed the presence of dens invaginatus type III (Oehlers). The extensive radiolucent area affected the neighboring teeth that were also submitted to endodontic treatment.

Endodontic therapy was initiated by gaining coronal access with the aid of an operating microscope (Alliance, São Paulo, SP, Brazil).

Removal of all the pulp tissues was performed and ultrasonic instrumentation (Obtura Spartan, Fenton, MO, EUA) was used to rupture and break the calcified anomalous structure, which resulted in a single foramen measuring approximately 3 mm in diameter.

After root canal preparation, instrumentation and irrigation with chlorhexidine gel 2% (Biodinâmica, Ibiporã, PR, Brazil) were performed. The real working length was determined with an Apical Locator Root ZX Mini (J. Morita, Califórnia, EUA).

The canal was irrigated with EDTA 17% (Biodinâmica, Ibiporã, PR, Brazil) for 3 minutes, and subsequently with physiological solution (Arboreto, Juiz de Fora, MG, Brazil) and chlorhexidine gel 2%.

The main cone was fabricated (Dentsply, Petrópolis, RJ, Brazil), modeled by the Tagger hybrid technique

Figure 1. Diagnostic radiograph reveals a type III dens invaginatus with bizarre morphology in the maxillary right lateral incisor. Considerable apical radiolucence is also observed.

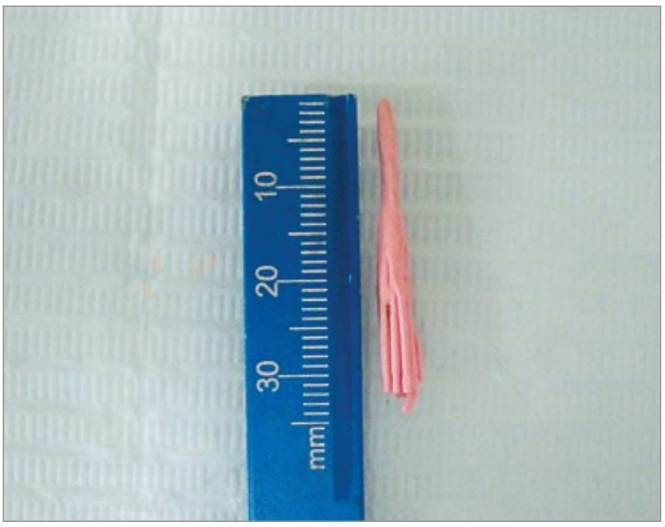

Figure 2. Main cone fabricated and modeled by the Tagger hybrid technique to adapt to the real working length of the canal.

Figure 3. Periapical radiograph immediately after main canal filling.

(Fig 2) to adapt to the real working length of the canal, and obturation (Fig 3) was performed with AH-Plus cement (Dentsply, Petrópolis, RJ, Brasil).

In the same session, paraendodontic surgery was performed. A mucoperiosteal flap (Fig 4) was performed and the bone recess was located. The pathological tissue was removed surgically with subsequent root-end resection. The E2 ultrasonic inserts (Helse, Santa Rosa de Viterbo, SP, Brazil) were used for retrograde obturation and MTA (Angelus, Londrina, PR, Brazil) for filling the cavity. Lyophilized bone (Baumer, São Paulo, SP, Brazil) and collagen membrane Genderm (Baumer, São Paulo, SP, Brazil) were used to fill the bone recess (Fig 5, 6 and 7).

During the 3-year follow-up period, periapical radiographs (Fig 8), cone-beam computed tomography with axial cuts (Fig 9) and 3D reconstruction (Fig 10) were performed. In the region of the lesion, bone regeneration was detected, with compatible bone density during this period.

Figure 4. The pathological tissue was removed surgically with subsequent root-end resection.

Figure 5. Lyophilized bone was used to fill the bone recess.

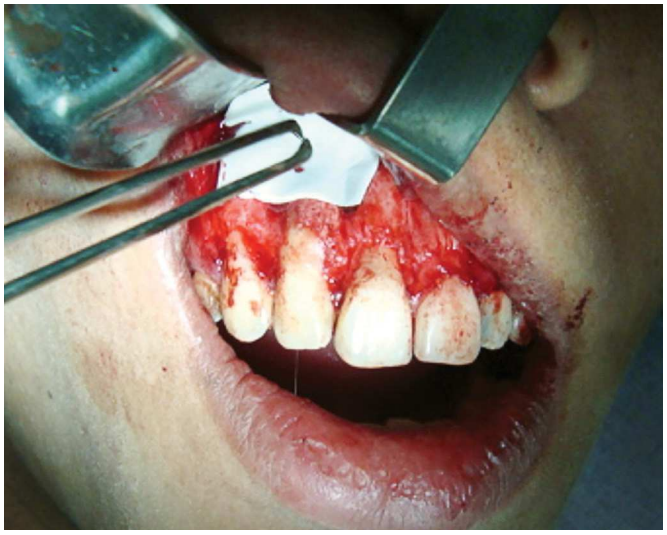

Figure 6. Collagen membrane was used to fill the bone recess.

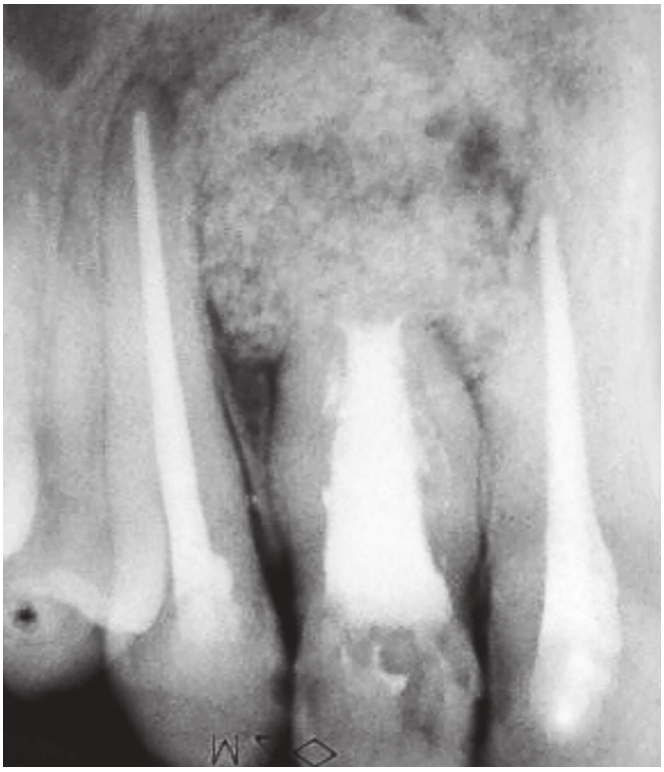

Figure 7. Periapical radiograph after endodontic and surgical treatment. Note the adequate obturation of the root canal system.

Figure 8. Periapical bone repair after 3-year follow-up.

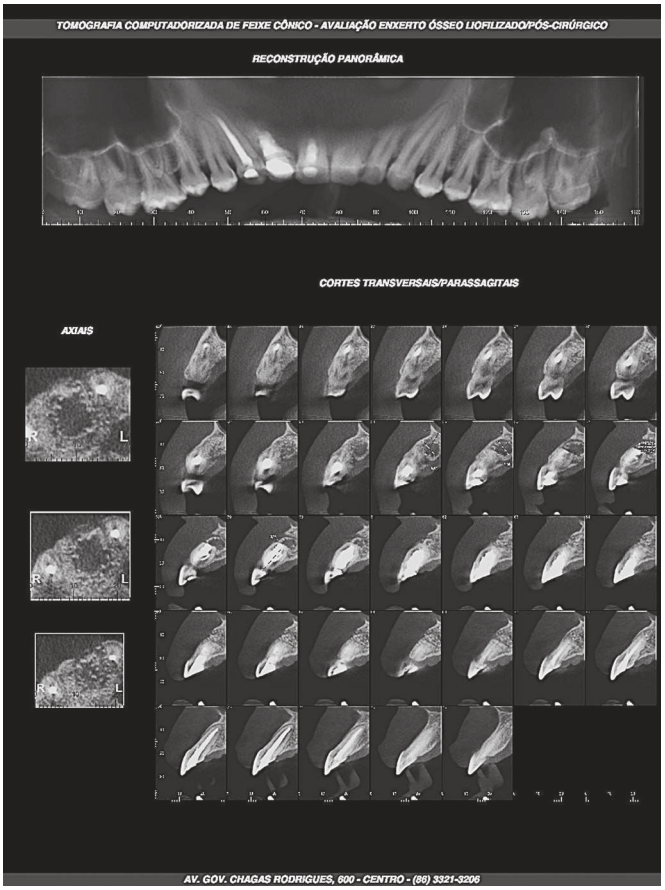

Figure 9. Cone beam computed tomography with axial cuts presentation of the case. Note in the axial section the periapical bone repair.

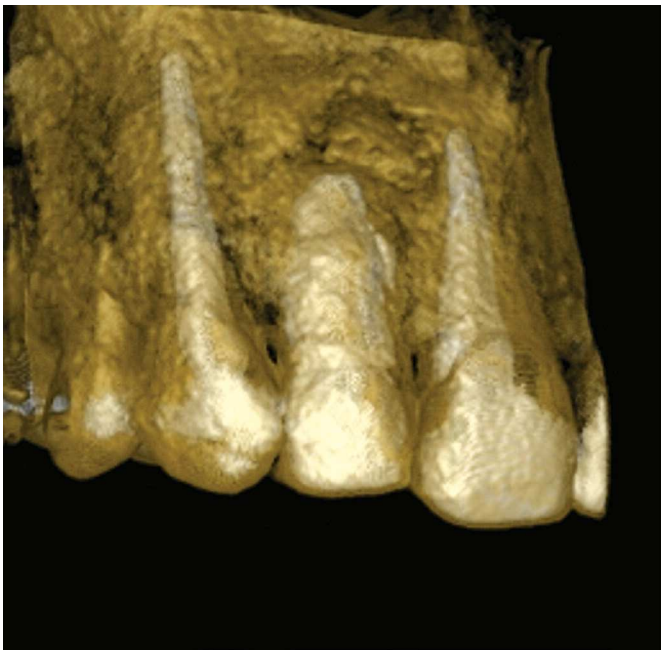

Figure 10. 3D reconstruction showing favorable results as regards repair of the lesion.

Discussion

This paper reports a case of the dens invaginatus and describes a successful surgical endodontic treatment. The tooth was classified as Oehlers type III dens invaginatus, along with necrotic pulp and a large periapical lesion.

The presence of dens invaginatus can result in several problems for patient, because of the bizarre morphology, that impairs proper cleaning, shaping and antisepsis, including an increased risk of caries development and pulp necrosis due to the higher predisposal to dental plaque accumulation in grooves and fissures. An exact understanding of the complex configuration of the root canal system is a prerequisite for most successful endodontic treatment of dens invaginatus type III associated with periapical lesion. It is considered a challenge demanding clinical experience and requiring complicated procedures, often associated and the lack of information provided by conventional dental radiographs in the third dimension. [5,6,11,13-15]

Pulp necrosis and acute periapical abscess are frequently found in dens invaginatus. In the present case, these events occurred because this case was not diagnosed early. In root treatment with pulp necrosis and periapical lesion, instrumentation, intracanal antiseptic medication followed by filling of the root canals are fundamental for a good clinical and radiographical outcome.[13] In many cases of conventional endodontic treatment, surgical or combined treatments need to be performed.[6] Initially, conventional treatment must be performed independent on the size of the periapical lesion. Surgical treatment is the second option considering the failure of conservative root canal treatment and in teeth with anatomical variation and extensive periapical inflammation that do not allow access to and cleaning of the entire system of canals, as occurs in many cases of type III.[13,16,17]

Some authors have reported fine results in the nonsurgical endodontic treatment of lateral incisors presenting dens invaginatus.[8,9,11] In contrast, in the present case, there was pulp necrosis throughout canal along with a large periapical lesion. This difference resulted in different strategies for root canal treatment.

Most cases of post-treatment failure are associated with the persistence of microorganisms in areas of the root canal systems not accessible, as well as the occurrence of extra-radicular infection.[18,19] In spite of the high success rates in conventional treatments, there is still a percentage of failures in which paraendodontic surgery is used to avoid loss of the tooth. In the case here reported, surgery was performed after removal of the extensive lesion, due to accentuated bone resorption. In view of this, lyophilized bone and collagen membrane were used for filling the cavity. MTA has been demonstrated to be biocompatible, to have good sealing properties; be insoluble in water; promote the formation of hard tissue and shows that it also has potential in the treatment of a range of severities of teeth with dens invaginatus. MTA's properties allow it to be used in a variety of clinical situations due to its biocompatibility and handling properties.[11,20,21]

As found in this case, the challenge begins with location of root canals openings. The use of the operating microscope and ultrasonic instrumentation provided the capacity to visualize and help with endodontic treatment. The operating microscope has brought about innumerable advantages, such as better lighting and magnification of the operative field, considering that in endodontics, the procedures are performed in obscurity and depend on the tactile sensitivity of the operator. Magnification is necessary to help in various clinical procedures and the greatest impact of this innovation is that the operating microscope enables magnification of up to 20 times.[22,23]

Removal of calcifications from root canals by means of ultrasound is an essential technique for the location and accessibility of the anomalous structure. Some cases may be treated with conventional techniques if the procedure with the microscope were used, providing an increased success rate for nonsurgical treatment.[22]

Advances in contemporary endodontic practice presently allow us to meet the biological and technical goals of endodontic treatment of a wide range of clinical situations through innovative new treatment strategies and may enhance and simplify the diagnosis and treatment of such cases, such as using cone-beam computed tomography.[8,11] The limitations of conventional radiography are well known. The diagnostic yield of this imaging is reduced by geometric distortion and the compression of three-dimensional structures on to a two-dimensional shadowgraph.[9,24]

The CBCT scan performed in this case presented data that were reconstructed to provide a three-dimensional representation of the dens invaginatus after 3 years of follow-up. The use of CBCT in the endodontic treatment of dens invaginatus has been reported.[9] The accurate management images may reveal abnormality which is unable to be detected in periapical radiographs.[25] It provides the detailed observation of inner tooth anatomy and can assist in the diagnosis and treatment of abnormal teeth.[26,27] However, its use should be justified by an analysis of the risk/benefit ratio because presents for patient an increased radiation exposure in relation to periapical radiographs. For this, a small volume CBCT scan was established in this case.[5,28]

The reconstructed images allowed an evaluation of bone healing obtained. This highlighted the success in surgical root canal treatment after 3-years of intervention. Therefore, CBCT has been shown to be particularly useful in assessing of treatments performed and can be used as an effective tool. At 3-year follow-up, the patient was asymptomatic and radiographical examination revealed substantial periapical bone regeneration without apical root resorption.

Conclusion

The combination of conservative and surgical treatment with the use of the operating microscope, ultrasound, apical barrier with MTA, lyophilized bone and collagen membrane, presented successful results, preserving for 3 years the dens invaginatus type III both functionally and esthetically. The use of the microscope and ultrasound enabled the operator to efficiently perform cleaning, removal of calcifications from the root canals and obtain visual magnification for performing retrograde obturation with MTA and lyophilized bone grafting in the cystic cavity. CBCT is an effective tool in the diagnosis and endodontic treatment teeth with anatomical variation and extensive periapical inflammation. It also, represents an additional complement to confirm endodontic success by evaluating the bone repair. The present report demonstrated the successful diagnosis and treatment of dens invaginatus using contemporary endodontic procedures.

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