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Case Report

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Conservative treatment of an invaginated maxillary lateral incisor with a c-shaped canal using cone beam computed tomography: a case report

Abstract

This report describes non-surgical treatment of an invaginated maxillary lateral incisor with three roots. The mesial root had a C-shaped canal, while the distal one had a type III dens invagination. Cone beam computed tomography (CBCT) was used as an adjunctive resource in the diagnosis and making decision about the required treatment. Clinical and radiographic follow up after 15 months revealed satisfactory periapical healing and absence of symptoms after 15 months.

Keywords: dens invagination, c-shaped canal, maxillary lateral, cone-beam computed tomography

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Introduction

Adequate information of the anatomy the pulp and its variations are necessary for an efficient endodontic treatment.[1] Tooth abnormalities are caused by genetic disorders or environmental factors during the tooth formation.[2] These abnormalities are common findings in maxillary lateral incisor. There are usually great variations in the shape of the crown, and also number and shape of the roots maxillary lateral incisors with 2 or more (6.6%) roots have been reported in the literature.[3,4]

Shape and number of the roots are determined by epithelial root sheath. Failure in connection of this sheath through the lingual or buccal surface can cause c-shape roots and canals. Also, c-shaped roots may be created by coalescence because of cement deposition through the time.[3] The frequency of C-shaped canals varies from 2.7% to 44.5% in mandibular second molar in different population.[5,6] This anatomic variation can be found in mandibular first and third molars, maxillary molars and first premolars, and rarely in maxillary laterals.[3]

Dens invagination is another developmental abnormality with 0.25-10% frequency, and can be found in maxillary lateral incisors.[7] This abnormality is caused by invagination of the enamel organ before its calcification.[2] Oehler[8] divides this abnormality into 3 types according to its severity. In the first type, the invagination is restricted to the crown. In the second type, the invagination passes CEJ and in the third type, invagination extends CEJ and can have a separate foramen.[9] Presence of these developmental abnormalities can alter the endodontic treatment and its prognosis.[7] Therefore, it is necessary to diagnose their presence and intensity before the treatment.

This article reports the endodontic treatment of an invaginated maxillary left lateral incisor with periapical lesion and 3 roots. Moreover the distal root had a c-shaped canal.

Case report

An 18 years old girl was referred by her general dental practitioner to the Department of Endodontic of Mashhad University of Medical sciences (Iran). The patient complained of pain and swelling around the maxillary left lateral incisor.

The tooth was not responsive to the electronic pulp tester (Parkell Electronic Division, USA) and thermal heat and cold with a refrigerant 1, 1, 1, 2-tetrafluoro-ethane (Hygenic Endo-Ice, Coltene Whaledent, Cuyahoga Falls, Ohio) pulp sensitivity tests. Patient reported discomfort on percussion as well as pain on palpation of periapical area.

The radiographic examination revealed an invaginated tooth with 3 roots and large periapical radiolucency (Figure 1). According to clinical and radiographic examination, the diagnosis was necrosis of pulp with symptomatic apical periodontitis.

Figure 1 Initial radiography.

A CBCT scan of the involved teeth was suggested to observe a three-dimensional image of this complex anatomy. The CBCT (Planmeca Promax, Asentajankatu 6, and Helsinki, Finland) showed that the tooth had three roots:

a. Distal root with a C-shaped canal

b. Mesial root with dens invagination type III abnormality

c. A middle root with one canal (Figure 2A & 2B).

Figure 2A Pre-operative coronal slice of the CBVT for maxillary left lateral incisor.

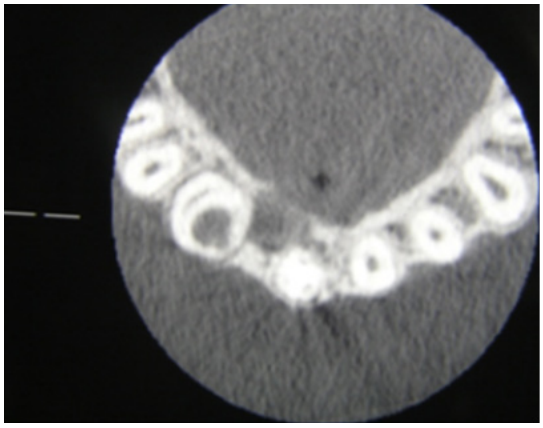

Figure 2B Axial slice.

The tooth was anesthetized and isolated, the temporary restoration was removed and the central canal was exposed. After mesiodistal extension of the coronal access, orifices of the two other canals became observable (Figure 3).

The Ribbon-shaped orifice of C-shaped canal started at the palatal surface of the tooth, and then swept around the distal to end at the distobuccal angle. The invaginated root canal had been calcified and was negotiated with #10 file (Dentsply Maillefer, Switzerland) as much as possible. The central canal was wide, conical and straight, with infections drainage. After determination of working length (Figure 4), all 3 canals were instrumented using the Step back technique and irrigated with 5.25% sodium hypochlorite (NaOCl) during the instrumentation. After biomechanical preparation of root canals, calcium hydroxide (Golcha dent, Karaj, Iran) was applied and the access cavity was temporarily sealed with cavit (Aria dent Coltosol, Tehran, Iran).

Figure 3 Photograph image of three orifices.

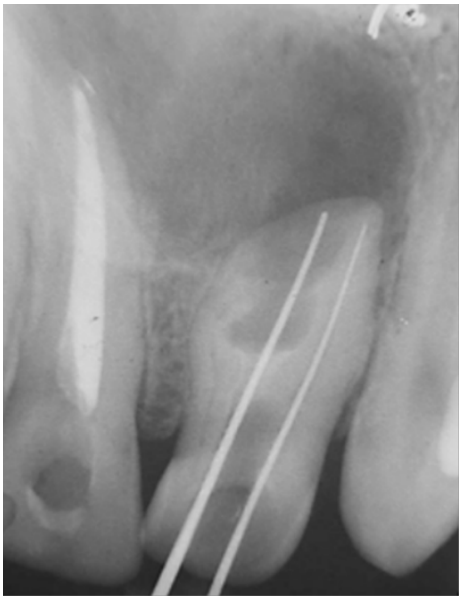

Figure 4 Working length determination.

In the next appointment after 14 days, the patient had no pain and swelling. After rubber dam isolation, calcium hydroxide was removed with master apical file and NaOCl irrigation. Working length of mesial canal was 5mm and the canal was filled by MTA (Dr. Lotfi, Tabriz, Iran). The C-shaped distal canal was filled with gutta percha (Aria dent, Tehran, Iran) using a lateral condensation technique and AH-26 root canal sealer. In the central canal with wide and irregular coronal and middle parts, the apical third was filled with lateral condensation of gutta percha and the middle and coronal parts were filled using with injection-molded thermo plasticized gutta percha (Beefill device, VDW, Munich, Germany) delivery system (Figure 5&6). One week after completion of endodontic treatment, patient had no clinical symptom and the tooth was restored with composite resin (Gradia direct, GC Corporation, Tokyo, Japan). At 15 month-follow up visit, the patient reported no symptoms and the radiography showed healing of periapical lesion (Figure 7).

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Figure 5 Master apical cone determination.

Figure 6 Immediate post-operative periapical radiograph.

Figure 7 Follow up radiography taken 15 month after nonsurgical endodontic treatment.

Discussion

Tooth abnormalities such as talon cusp, dens invagination and palatogingival groove often affect maxillary incisors. Among the maxillary incisors, lateral incisors more often influenced without obvious reason.[10,11] It is assumed that the small tooth germ can be influenced by the pressure of tooth germ of central and canine incisors that have been developed several months earlier.

The created pressure on tooth germ during morpho differentiation may cause dental lamina of buckling (out folding or in folding). It seems that these malformations are more related to genetic disorders because they are more commonly found in some ethnics and are often accompanied with other anomalies.[12] Moyer explains that the most distal tooth in each group shows the most diversity in size, shape and calcification time.[13] However coincidence of several tooth abnormalities is nearly uncommon.

It has been reported that maxillary lateral incisors are found to be the most common teeth with these abnormality (85%) with the frequency of 3.3% type III invagination.[14] In the third type, the invagination penetrates into the apical region throughout the root which develops a second foramen in apical or periodontal region without direct relationship with the pulp.[15,16] Invagination makes the irritant substances get reach an area which is separated from the pulpand covered by a thin layer of enamel and dentin. In some cases the enamel layer is incomplete. Also there may be a canal between the invagination and the pulp.[17] Alani et al.,[17] suggest that in case of peri-invagination periodontitis and healthy pulp, all the efforts must be made in order to keep the pulp vital.[13,18] In present case, endodontic treatment was of the main canal done because of its necrosis.

Conventional radiography plays an important role in root canal assessment, however; it provides a two-dimensional image of a three-dimensional structure.[19] By using CBCT and microscope, recognition and decision making on the non-surgical treatment become possible in most complicated cases of dens invaginations.[8] Accurate morphology of root canal was diagnosed with the help of CBCT in present case.

Diagnosis of dens invagination is usually accidental. A usually large unusual crown, peg or barrel-shaped crown or a deep foramen caecum may clinically accompany dens invagination.[20,10]

MTA is applied in the treatment of invaginated teeth because of its biological compatibility, its healing ability by induction of mineralized tissue deposition, excellent sealing ability in wet condition and also declined treatment time.[16] Therefore we used MTA in present case.

The existence of c-shaped canal in the invaginated teeth has already been reported.[21] Whether this type of canal is most rottenly seen in invaginated teeth or not is still a question that needs to be studied. The response to this question is especially of utmost importance in the prognosis of treatment of invaginated teeth. Using microscope and CBCT are helpful in the correct diagnosis and treatment of the invaginated teeth them.

Conclusion

CBCT provides the opportunity for detailed observation of inner tooth anatomy and can be an effective help in the diagnosis and treatment of tooth abnormalities.

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Conflicts of interest

The author declares there is no conflict of interest.

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