



CASE REPORT

A maxillary lateral incisor with four root canals

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Abstract

Kottoor J, Murugesan R, Albuquerque DV. A maxillary lateral incisor with four root canals. *International Endodontic Journal*.

Aim To describe the successful non-surgical endodontic management of a permanent maxillary lateral incisor tooth with four root canals.

Summary Aberrant morphology of root canals can occur in any tooth, including maxillary lateral incisors. In the presented case, clinical examination and radiographs clearly depicted the presence of four root canals in a right maxillary lateral incisor. The differential diagnosis included fusion, gemination, dens invaginatus or a combination of these. The report emphasises the need for attention during root canal treatment of maxillary lateral incisors.

Key learning points

- Clinicians should be aware of the variable root canal anatomy in maxillary lateral incisor teeth.
- Careful examination of radiographs and the internal anatomy of teeth are essential prerequisites for successful root canal treatment.
- Four root canals in maxillary lateral incisors is a possibility.

Keywords: maxillary lateral incisor, root canal, root canal anatomy, tooth morphology.

Received 9 August 2011; accepted 14 October 2011

Introduction

A proportion of problems that occur during root canal treatment are because of an inadequate knowledge of tooth morphology and canal systems (Al-Qudah & Awawdeh 2006). Thus, to ensure the long-term prognosis of a tooth undergoing root canal treatment, it is imperative that the morphology of the root canals and their numerous variations are assessed before initiating root canal treatment (Vertucci 1984, Caliřkan *et al.* 1995).

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Maxillary lateral incisors have a variety of different shapes, resulting in diagnostic and treatment challenges. There are reports of maxillary lateral incisors in fusion with a supernumerary tooth (Blaney *et al.* 1982) or an adjacent central incisor (Mehlman 1978), gemination (Yücel & Güler 2006), dens invaginatus (Schmitz *et al.* 2010), dens evaginatus (Dash *et al.* 2004), a combination of dens invaginatus and dens evaginatus (Mupparapu *et al.* 2004), two (Altuntaş *et al.* 2010) or three root canals with a dens invaginatus (Walvekar & Behbehani 1997). Other reported variations include two rooted laterals (Ravindranath *et al.* 2011), a single root with two canals (Ghoddusi *et al.* 2010) and a C-shaped root canal (Bóveda *et al.* 1999). This case report presents a maxillary lateral incisor with four root canals.

Case report

A 16-year-old Indian male was referred by his general dentist for root canal treatment of the maxillary right lateral incisor (tooth 12). The root canal treatment had been initiated by the general dentist, who opted for a referral after observing its unusual root canal morphology.

On clinical examination, tooth 12 did not appear to have any coronal morphological variation and was identical to its left counterpart. There was no discoloration of the crown. The tooth had mild tenderness to percussion; however, there was no evidence of swelling or sinus tract. The mucosa and the underlying alveolar bone were not tender to palpation. Gingival probing depths and tooth mobility were within physiologic limits. The tooth did not respond to electric and thermal pulp sensibility tests whilst the contralateral and adjacent teeth responded within normal limits. The temporary restoration within the access cavity had been missing for 1 week.

The preoperative periapical radiograph suggested the following possibilities: (i) fusion of the lateral incisor tooth with a supernumerary tooth; (ii) 'dens in dente'; (iii) multiple root canals in a bulbous root; and (iv) a diffuse apical root lesion (Fig. 1a). From the clinical and radiographic findings, the maxillary left lateral incisor was diagnosed as a necrotic pulp with an aberrant root canal system and symptomatic apical periodontitis; for which root canal treatment was planned.

The patient was administered local anaesthesia of 2% lidocaine with 1 : 100 000 epinephrine. Under rubber dam isolation, the access cavity was modified. Clinical exploration with a DG-16 endodontic explorer (Hu-Friedy, Chicago, IL, USA) revealed two root canal orifices in a labio-lingual direction. Two 15 size K-files, one in the labial and the other in the lingual orifice, were placed, and a radiograph was taken (Fig. 1b). Radiographically, two radiolucent lines mimicking missed root canals were noticed on either side of the K-files, which aroused the suspicion of two additional canals in a mesio-distal direction (Fig. 1b). To locate the orifices of the mesial and distal canals, the access cavity was extended in a mesio-distal direction (Fig. 1d). Coronal flaring for all root canal orifices was performed with Gates Glidden drills. Working lengths were determined with an apex locator (Root ZX; Morita, Tokyo, Japan) and confirmed radiographically (Fig. 1c). Under copious irrigation with 2.5% sodium hypochlorite and 17% EDTA, the root canals were cleaned and shaped up to a size 35 master apical file using a step-back technique. The canals were dried with sterile paper points (Dentsply Maillefer, Ballaigues, Switzerland), and calcium hydroxide paste (Calcicur; VOCO, Cuxhaven, Germany) was placed as an inter-appointment medicament. The access cavity was sealed temporarily with Cavit (3M ESPE AG, Seefeld, Germany).

The patient was recalled after a week at which time the tooth was asymptomatic. The root canals were irrigated, dried and filled by cold lateral compaction of gutta-percha using a zinc oxide eugenol sealer (Kemdent; Associated Dental Products Ltd, Swindon, UK). The

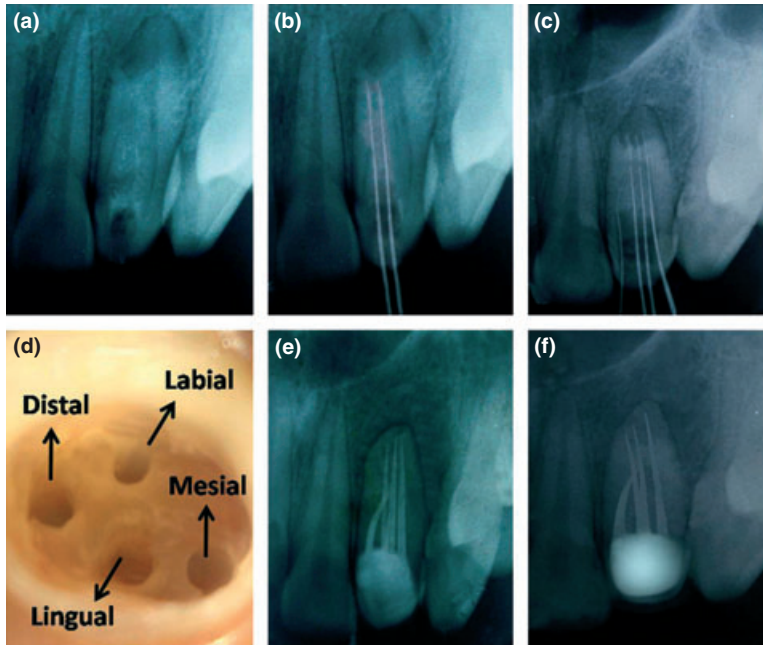


Figure 1 (a) A preoperative radiograph of tooth 12 showing the likelihood of root canal aberration. (b,c) Radiographs of tooth 12 to confirm the working lengths and the aberrant root canal morphology. (d) Access opening showing the four root canal orifices. (e) A postoperative radiograph of tooth 12 showing the root canal system of the tooth. (f) An 18 month recall showing complete healing.

access cavity was restored with glass ionomer cement (Fuji IX; GC Corp., Tokyo, Japan), and a postoperative radiograph was taken (Fig. 1e). The tooth was asymptomatic and showed resolution of the periapical lesion during the subsequent follow-up period of 18 months (Fig. 1f).

Discussion

Maxillary lateral incisor teeth are generally considered to be single-rooted teeth with a single canal (Burns & Herbranson 2002). Independent studies (Green 1956, Pineda & Kuttler 1972, Vertucci 1984) consistently reported that all maxillary lateral incisors have single root canals. On the contrary, there are reports of maxillary lateral incisors with two (Christie *et al.* 1981, Friedman *et al.* 1984, Thompson *et al.* 1985) and three root canals (Peix-Sánchez & Miñana-Laliga 1999, Jung 2004). All these cases are thought to be the result of abnormal development of the tooth and the root. They often manifest clinically as gemination, fusion, concrescence or dens invaginatus (Indra *et al.* 2006). Amongst these morphological defects, dens invaginatus presents with the utmost diagnostic, treatment and prognostic challenges. In dens invaginatus, maxillary lateral incisors are most affected and are usually associated with complex root canal systems (Hülsmann 1997). At times, there might be some degree of confusion over the differentiation of gemination and fusion (Brook & Winter 1970). In fact, attempts to distinguish the difference between the two anomalies do have clinical relevance. In this case report, based on the available clinical and radiographic data, a definitive diagnosis of fusion, gemination or dens invaginatus could not be established.

The clinical appearance of dens invaginatus may vary from a routinely observed trapezoidal form to more unusual forms such as peg-, barrel- or conical-shaped crowns,

with wider labio-lingual or mesio-distal diameters, with talons cusps or grooving of the palatal enamel coincident with the entrance of the invaginated (Bishop & Alani 2008). However, neither a cervical lingual groove (clinically) nor a deep invagination of the enamel into the interior of the root (radiographically) were observed in this particular case. This could be attributed partly to the destruction of the critical lingual surface architecture, caused by the initial access preparation performed by the general dentist. Although four individual root canals may lead to a diagnosis of fusion, the diagnosis of gemination can also be made, as there were no missing teeth and the involved tooth had a single root. In addition, it is interesting to observe that in contrast to these anomalies, the crown of the tooth was almost normal in size, favouring the diagnosis of dens invaginatus. Thus, the question remains unanswered: fusion, gemination or dens invaginatus?

In the present case report, after determining the working length of individual root canals, the canals were individually explored with K-files. However, subsequent to the placement of the file in the mesial canal, the file in the labial canal did not reach the full working length. Hence, it was concluded that the mesial and labial root canals joined at the apical third of the root and exited through one apical foramen, whereas the distal and lingual canals had a separate path from the orifice to the exiting foramina. This pattern, of four canals within one root has not been described in any of the extensive classifications for root canal systems, proposed by various authors (Gulabivala *et al.* 2001, Sert & Bayirli 2004).

Conclusion

The present case report describes root canal treatment of a maxillary right lateral incisor with four root canals that could be differentially diagnosed as gemination, fusion or dens invaginatus.

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