

## Surgical treatment of a periradicular lesion on an invaginated maxillary lateral incisor (*dens in dente*)

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### Summary

The complex anatomy of invaginated teeth make their root canal treatment difficult. Moreover, this treatment may compromise the future of the tooth if it is destined to support a post-retained coronal restoration. This case reports the successful surgical root canal treatment of an invaginated tooth using a retrograde filling with gutta-percha. After surgical exposure of the root-end and cleaning of the root canal, the gutta-percha was compacted in the root canal which had been coated previously with a zinc oxide–eugenol cement. The gutta-percha was then cold-burnished. Periapical radiographic examination after 1, 2, 3, 6 and 12 months showed periapical healing with osseous formation. This procedure, resulting in minimal loss of hard tissues, permitted subsequent restoration of the tooth.

**Keywords:** *dens in dente*, dens invaginatus, gutta-percha, retrograde filling.

### Introduction

*Dens in dente* has always been considered a spectacular dental anomaly. It is of embryonic origin and results from epithelial invagination within the depths of the ecto-mesenchymatous papilla. At a given moment during the development of the tooth, an amelodentinal structure, more or less developed, forms within the pulp (De Smit *et al.* 1984). Clinically, the *dens in dente* is distinguished by anomalies of form, volume or structure which can affect both the crown and the root (Ohlers, 1957). The more frequently seen abnormalities of the crown are accentuation of the cingulum, increase in the bucco-lingual or mesio-distal dimension or, on the contrary, decrease in these dimensions. Anomalies of the root may affect only part of it or sometimes extend to

the apex. Radiographically, it sometimes gives the appearance of a tooth within another tooth, hence the name *dens in dente*. With regard to the epidemiology, this anomaly is most often found in the maxillary lateral incisor (Pindborg, 1970). Cases are rarely found in the mandible. One may also note that deciduous teeth are very rarely involved.

Because of the disturbed structure, the enamel covering the invagination is hypomineralized and therefore fragile. Chewing may result in the destruction of this layer and expose the pulp at a specific surface, sometimes even only as a pinpoint exposure. This explains the frequently observed pulpal necrosis of these teeth in the absence of frank caries. This necrosis may develop even before the complete maturation of the tooth (Villa *et al.* 1959).

The difficulty in treating such teeth is enhanced by the complexity of their anatomy. Dechaume (1966) and Farmer & Lawton (1966) proposed extraction as the treatment of choice to avoid complications. Root canal therapy has since been proposed to maintain these teeth in the dental arch (Grossman 1974, Tagger 1977, Zillich *et al.* 1983). In some cases, pulpectomy and root canal filling can be performed immediately (De Smit & Dermaut 1982, Camus *et al.* 1986). Sometimes, however, the state of root development necessitates an additional step using calcium hydroxide to allow apexification (Fergusson *et al.* 1980, Shay 1984). The complexity of the internal anatomy of the tooth presents problems which might result in failure, the root canal treatment cannot always presume obturation which extends to the apex (De Smit & Dermaut 1982). Therefore, a surgical approach can be indicated, consisting of an apical resection extending to the apical limit of an orthograde root filling or, when this simple resection is not possible, a retrograde filling may be indicated (Weine 1982).

The case presented here reports the successful treatment of an invaginated tooth presenting with an apical

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lesion. The choice of retrograde filling during periradicular surgery was determined by considerations involving future restoration of this tooth.

## Case Report

### Examination

A 23-year-old woman, in good health, presented for consultation because of a sinus in the area of the apex of the maxillary right lateral incisor (tooth 12). She was referred by her dentist who had taken a radiograph of tooth 12 5 years previously (Fig. 1). Since this initial examination the patient had not returned to her practitioner. She decided to return for consultation following the appearance of a slight swelling associated with a labial sinus. Extraoral examination showed a normal appearance of the head and neck. Occlusion was normal without missing teeth. The intraoral soft tissues were normal except in the area of tooth 12 where a slight swelling with a sinus related to the level of the middle of



**Fig. 1** The maxillary lateral incisor fully erupted with an immature apex. The *dens in dente* is easily recognized. A slight discontinuity of the enamel at the level of the occlusal surface offers a pathway for contamination of the pulp although, at this stage, no necrosis or sinus has occurred.

the root was noticed (Fig. 2). This tooth presented as an anatomical anomaly, the crown of the tooth being conical and reduced in size (microdontia). The tooth did not respond to thermal and electrical sensitivity tests and there was no associated periodontal pocket. There was slight mobility (2 mm) and the tooth was sensitive to axial percussion. There was slight fluctuation at the level of the sinus and some pain on palpation of the oral mucosa. The tooth had no history of caries and restorations or trauma and no fracture was detected.

Radiographic examination (Fig. 3) of tooth 12 showed evidence of an open apex, a coronal radicular invagination and a short root with an associated periradicular radiolucency which began at the apex and extended along the distal side of the root. A diagnosis of chronic periradicular abscess with periodontitis was made.

### Treatment

It was decided to perform periradicular surgery under local anaesthesia. A full-thickness muco-periosteal flap was raised following an intrasulcular incision and distal relieving incision. The lesion had perforated the cortical bone. The margins of this perforation were smoothed using a round bur in a slow speed handpiece with physiological saline irrigation. Curettage of the soft tissue around the root-end of the tooth was undertaken. An haemostatic plug consisting of a mixture of alginate calcium fibres (Coalgan, Brothier, Paris, France) and surgical wax (Bone wax, Ethicon, Sommerville, NJ, USA) was placed in the bony crypt around the apex. The root canal was cleaned through the apical opening using sodium hypochloride (2%) irrigation with curved files (diameter 15–60). The mixture of calcium alginate



**Fig. 2** The intra-oral appearance of the maxillary lateral incisor. The tooth is conical and is reduced in size (microdontia). Note the presence of a sinus at the level of the apex.



Fig. 3 The apex of the tooth is still immature, with a periradicular lesion, extending onto the distal surface of the root.

fibres and surgical wax was removed and changed after physiological saline irrigation of the osseous cavity. The root canal was dried and then coated with a zinc oxide–eugenol cement (Pulp Canal Sealer, Kerr, Paris, France) from its apical opening to its coronal end using a precurved file. Gutta-percha (Mynol, Block Drug Corporation, Jersey City, NJ, USA) was softened with heat, introduced into the root canal with an amalgam carrier and compacted with a small-diameter spreader. Another increment of gutta-percha compacted with a spreader of the diameter of the cavity completed the filling. Once the compaction was terminated, the filling was smoothed using an helicoidal tungsten-carbide bur and cold burnished (Fig. 4). A radiograph was taken to check the quality of the obturation (Fig. 5). The mixture of surgical wax and alginate fibres was removed and the bony crypt rinsed with physiological saline. The flap was repositioned when the osseous cavity was filled with blood and sutured. Post-operative medication included antibiotics (amoxicillin 2 g per day for 6 days), an anti-inflammatory agent (tiaprofenic acid 600 mg per day for 4 days) and a mouthwash (chlorhexidine three times per day for 5 days).



Fig. 4 After compaction of the gutta-percha, the preparation was rinsed with saline and then cold burnished.



Fig. 5 Radiographic examination of the obturation shows that gutta-percha filled the root canal to the limit of the invagination. Note that the apical third of the root in its distal part presented an accessory canal which was filled during compaction; a puff of cement is visible.

#### Post-operative evaluation

Post-operative review at 15 and 30 days and 2, 3, 6, 9 and 12 months (Fig. 6) showed progressive healing. This healing was analysed on the basis of both clinical and



Fig. 6 Post-operative radiographic examination at 12 months after surgery shows complete healing of the lesion i.e. disappearance of the rarefied bone, the reconstitution of normal bone around the root and the reconstitution of an uninterrupted regular lamina dura.

radiographic criteria. Clinical criteria were the disappearance of the sinus, absence of tenderness to palpation or percussion and the lack of mobility. Radiographic criteria were the reconstitution of a normal bone around the root, the presence of an uninterrupted ligament of regular thickness, and the reconstitution of an uninterrupted regular lamina dura.

A jacket crown without a post was made as the definitive coronal restoration (Fig. 7).

## Discussion

In this case the provision of a crown for this tooth determined the choice of the treatment. If we had chosen to prepare a post-retained crown, preliminary root canal treatment with calcium hydroxide would have been necessary to allow root-end closure (Fergusson *et al.* 1980). An orthograde root filling would have followed root-end closure. However these treatments would probably have necessitated the removal of the invaginated coronal tooth structure. This operation would



Fig. 7 A crown without radicular post was constructed subsequently.

have weakened the coronal and radicular portions of the tooth further, which were already compromised by its abnormally small size. Immature teeth which have undergone an apexification procedure show thin canal walls which may fracture when a post is required for retention of the crown (Trope *et al.* 1985, Saupe *et al.* 1996). Therefore it was preferred to select a less invasive treatment to retain the coronal portion of the tooth intact which served subsequently as a support for the restoration.

This retrograde filling was performed using gutta-percha together with a zinc oxide–eugenol root canal sealer as previously described by Reit & Hirsch (1986) and Flath & Hicks (1987). The main reason for selecting these materials instead of other retrograde filling materials, such as EBA, amalgam or glass-ionomer cements (Friedman 1991), is the ability of gutta-percha to be heat-compacted, allowing the cement to penetrate parts of the canal inaccessible to mechanical instrumentation. The advantages and the limitations of this well-known three-dimensional-obturation technique have been largely documented for orthograde fillings (Schilder 1967, Nguyen 1991, Stabholz *et al.* 1991) and are also relevant for retrograde fillings. According to these guidelines, special attention was paid during the obturation phase to the following points: (1) the canal sealing cement was prepared to a creamy consistency in order that it might penetrate the furthest distance into the root canal space, and that the film between the gutta-percha and the canal wall might be reduced to the minimum. Even with subsequent dissolution, percolation might be reduced to the minimum; (2) the temperature of the gutta-percha was measured so that it did not exceed 50°C which permitted compaction with minimal contraction upon cooling; (3) the choice of Mynol cones

of gutta-percha is based on their thermomechanical properties (Marciano *et al.* 1992); in effect, they remain plastic for a long time which permits better compaction; (4) generous irrigation with physiological saline after compaction permitted the rapid cooling of the gutta-percha which then returned to its solid, non-plastic, beta form; (5) the cold burnishing of the gutta-percha was performed because it results in a better adaptation between the gutta-percha and the walls of the cavity.

After careful retrograde cleaning and shaping of the root canal, the compaction of the gutta-percha permitted the filling of the root canal from the apical end to its coronal end including an accessory canal without necessitating a palatal access opening in the crown. Part of the coronal structure remained radiographically free of obturation material and may therefore be considered to be a source of bacterial contamination, especially if the slight discontinuity of the enamel on the occlusal surface observed in Fig. 1 or Fig. 3 was the source of microbial penetration as suggested by Villa *et al.* (1959). However, clinical evidence of healing of the pre-existing lesion and absence of recurrence after 1 year indicate that the root canal treatment and the covering of the tooth with a crown enabled the retention in the dental arch of a tooth which would have been condemned if this procedure had not been performed.

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