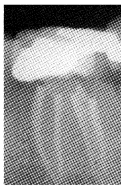
International Endodontic Journal

doi:10.1111/j.1365-2591.2010.01816.x



CASE REPORT

Differential diagnosis of endodontic-related inferior alveolar nerve paraesthesia with cone beam computed tomography: a case report

G. Gambarini[1], G. Plotino[1], N. M. Grande[1], L. Testarelli[1], M. Prencipe[1], D. Messineo[2], L. Fratini[2] & F. D'Ambrosio[2]

[1]School of Dentistry, and [2]Department of Head and Neck Radiology, Sapienza University of Rome, Rome, Italy

Abstract

Gambarini G, Plotino G, Grande NM, Testarelli L, Prencipe M, Messineo D, Fratini L, D'Ambrosio F. Differential diagnosis of endodontic-related inferior alveolar nerve paraesthesia with cone beam computed tomography: a case report. *International Endodontic Journal*, **44**, 176–181, 2011.

Aim To discuss the use of cone-beam computed tomography (CBCT) in the differential diagnosis of a case of labiomandibular paraesthesia caused by extrusion of endodontic sealer into the mandibular canal.

Summary A 59-year-old woman suffering from a paraesthesia on the left posterior mandible and numbness on the left side of the lower lip was referred to an endodontic specialist 1 month after multiple root canal treatments. A panoramic radiograph revealed the presence of extruded root filling material beyond the apex of the mesial root of the mandibular left second molar and also beyond the apex of the first premolar. A cone beam computed tomography examination was undertaken, which confirmed the presence of radiopaque root canal filling material in the periapical area of the second molar, and revealed that the material was inside the mandibular canal. No extruded filling material was found inside the mental foramen beyond the apex of the first premolar tooth.

Key learning points

- Small field of view CBCT (where possible) can be considered an effective radiographic diagnostic device when endodontic-related inferior alveolar nerve or mental foramen paraesthesia are suspected.
- CBCT is able to provide detailed three-dimensional images of the tooth, the root canal system and the surrounding tissue.

Keywords: cone beam computed tomography, inferior alveolar nerve, paraesthesia.

Received 29 April 2010; accepted 10 October 2010

Correspondence: Gianluca Gambarini, Via Cavour 325, 00184 Rome, Italy (e-mail: ggambarini@gmail.com).

Introduction

The most important objective of successful root canal treatment is to thoroughly cleanse the root canal system, removing microorganisms, their substrates as well as organic and inorganic contents from the canal space (Wu *et al.* 2006). Without proper chemo-mechanical instrumentation, the remaining irritants may reduce the success rate and result in post-treatment disease (Friedman 2002). However, effective canal cleaning remains one of the greatest challenges in endodontic therapy (Hülsmann *et al.* 2005). The elimination of infected pulp and dentine, adequate root canal preparation and filling constitute the basic principles of root canal treatment. Ideally, the filling material should be confined to the root canal without extending to periapical tissues or other neighbouring structures. Endodontic filling material beyond the apical foramen may give rise to clinical manifestations as a result of the toxicity of the product, though minor material extrusions are generally well tolerated by the periradicular tissues (Pertot *et al.* 1992).

When the filling materials are either close to or in intimate contact with nerve structures, anaesthesia, hypoaesthesia, paraesthesia, or dysaesthesia may occur. In mandibular teeth posterior to the mental foramen, extrusion of filling material can be responsible for damage to the inferior alveolar nerve (Conrad 2001), and labiomandibular paraesthesia is the most frequent complication that can occur (Pogrel & Thamby 1999, Tilotta-Yasukawa *et al.* 2006). Most cases have been reported in connection with mandibular second molars, but cases related to first molars and premolars have also been reported (Knowles *et al.* 2003).

It is generally considered that four possible types of factor can cause tissue damage (Conrad 2001, Tilotta-Yasukawa *et al.* 2006, Pogrel 2007): (i) chemical factors because of the neurotoxic effect from the products used to clean (irrigating solutions, intracanal medications, etc.) or fill root canals; (ii) mechanical trauma from over-instrumentation; (iii) a pressure phenomenon from the presence of core filling material or sealer within the inferior alveolar canal; and (iv) tissue overheating because of incorrect warm condensation techniques.

Treatment of endodontically related paraesthesia remains controversial, varying from a wait-and-see approach (Ørstavik *et al.* 1983) to early (Yaltirik *et al.* 2002), if not immediate (Grotz *et al.* 1998), surgical debridement of the inferior alveolar nerve via a number of possible approaches. These include extraction of the tooth and approaching the nerve through the socket (Yaltirik *et al.* 2002), decortication of the mandible achieved laterally (Grotz *et al.* 1998) from an intraoral (Fanibunda *et al.* 1998) and extraoral (La Banc & Epker 1984) approach, and sagittal splitting of the mandible to expose the nerve within the split (Scolozzi *et al.* 2004).

The aim of this report is to describe the differential diagnosis of a case of labiomandibular paraesthesia due to endodontic sealer extrusion into the mandibular canal, and the use of cone-beam computed tomography (CBCT) to aid the diagnosis and treatment.

Report

A 59-year old woman suffering from paraesthesia on the left posterior mandible and numbness on the left side of the lower lip was referred to an endodontic specialist 1 month after multiple root canal treatments. The symptoms had occurred immediately after the endodontic treatment of a mandibular left first premolar and second molar, the latter already restored with a crown. Both teeth had been root filled in one appointment with lateral condensation of gutta-percha and a zinc oxide eugenol (ZOE)-based sealer. The patient also reported a tingling sensation in the buccal gingiva.

Medical and familial histories provided no relevant information and physical extra- and intraoral examination was within normal limits except for the paraesthesia.

A panoramic radiograph (Fig. 1) had been prescribed by the referring dentist. It showed radiopaque material (overfilling) beyond the apex of the mesial root of the mandibular left second molar and also beyond the apex of the mandibular left first premolar.

Symptoms, the history of previous root canal treatments and the close proximity of the material to the mandibular canal and mental foramen suggested the accidental extrusion of endodontic sealer into the mandibular canal and/or mental foramen. However, the panoramic radiograph was not able to reveal whether the material was inside or outside the alveolar nerve canal nor precisely confirm which tooth was responsible for the symptoms and signs.

The patient was concerned about the prognosis and demanded to know the exact cause of the paraesthesia and the potential risk of damage to the alveolar nerve. Since a more precise three-dimensional examination was needed to reveal the presence of extruded material in the nerve canal, the patient consented to further radiographic imaging. Therefore, a cone beam radiographic examination was undertaken (Newtom VGI, QR, Verona, Italy), which clearly showed radiopaque root canal filling material in the periapical area of the mandibular left second molar and that the material was inside the mandibular canal (Figs 2 and 3). On the contrary, no extruded filling material was found inside the mental foramen beyond the apex of the mandibular left first premolar (Figs 4 and 5). A CBCT of the whole mandible was taken because the patient also had a problem tooth in the mandibular right third molar area.

After discussing treatment options with the patient, including a surgical approach, it was decided to monitor progress with periodic follow-up visits. Management started with an anti-inflammatory regimen for 4 weeks. Symptoms improved slowly and disappeared after 6 months, although no visible radiographic signs of resorption of the extruded material were noted in a periapical radiograph taken after 6 months. The patient was

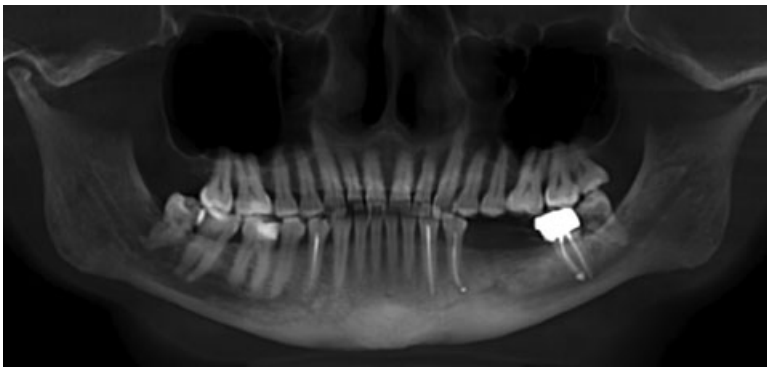


Figure 1 A panoramic radiograph, following endodontic treatment of teeth 34 and 37.

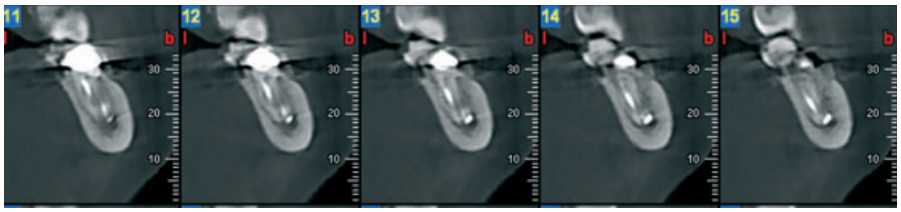


Figure 2 CBCT examination (coronal slices/cuts) of tooth 37 revealing filling material extruded in the mandibular canal.

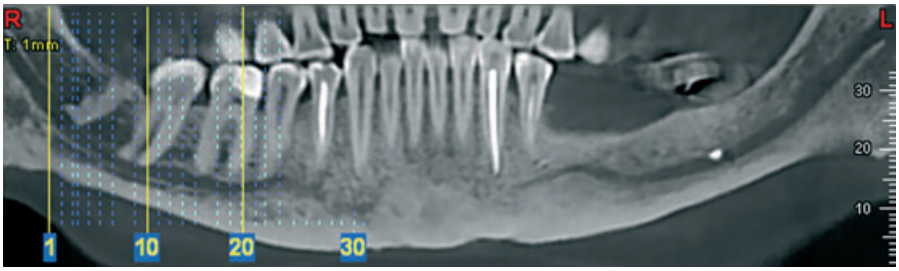


Figure 3 CBCT sagittal slice/cut through the filling material present into the mandibular canal.

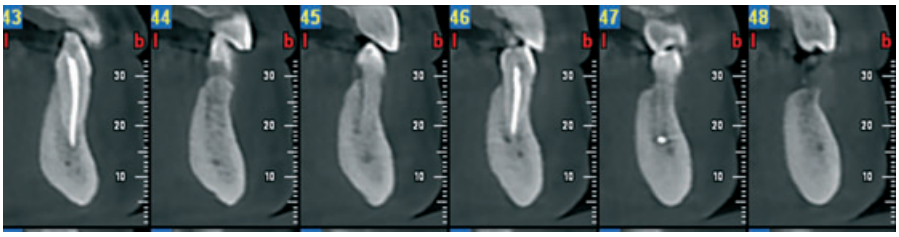


Figure 4 CBCT examination (coronal slices/cuts) of tooth 34 revealing that the filling material was not in contact with the mandibular canal.

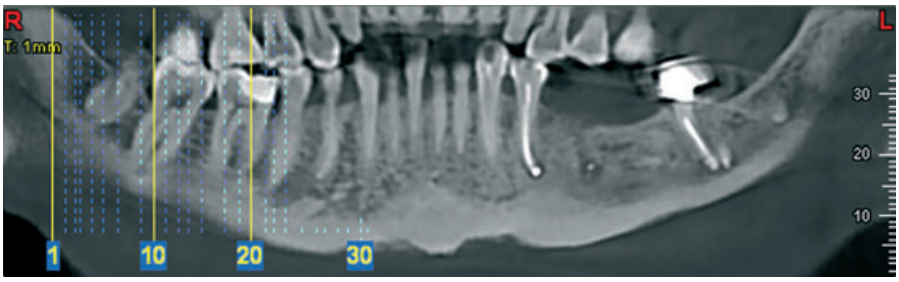


Figure 5 CBCT sagittal slice/cut through the filling material extruded from tooth 34.

satisfied with the outcome and refused to undertake any further radiographic or CBCT examination of the area.

Discussion

Endodontic materials have been reported to induce pain and paraesthesia when in contact with alveolar nerves (Escoda-Francoli *et al.* 2007). Paraesthesia is a permanent or episodic sensation of ticking, prickling, or tingling of the lower lip (Di Lenarda *et al.* 2000). Numerous case reports have described the occurrence of paraesthesia during and after root canal treatment of both premolars (Giuliani *et al.* 2001) and molars (Antrim 1978). It is hard to evaluate whether paraesthesia is caused by over-instrumentation or overfilling, especially if the treatment has been performed in a single visit. In fact, extrusion can be also a consequence of apical transportation or over-enlargement of the apical root canal because of over-instrumentation.

It is not always possible to make a precise diagnosis of extrusion into the nerve by showing the contact of the filling material with the alveolar nerves using traditional endodontic radiographs. One of the major problems is that intraoral radiographs only

reveal limited information. The amount of information gained from analogue and digital periapical radiographs is incomplete because the three-dimensional anatomy of the area being radiographed is compressed into a two-dimensional image or shadowgraph (Patel *et al.* 2009). Patel *et al.* (2009) demonstrated CBCT's superior diagnostic accuracy compared with intraoral radiographs.

In this case the use of CBCT was justified as the patient was understandably concerned and wanted to know the risk of nerve damage and the exact position of the material in relation to the nerve canal.

The use of biocompatible materials such as gutta-percha and ZOE based sealers did not suggest an immediate surgical approach, but rather a wait-and-see approach. It is well known that toxicity of ZOE-based sealers tends to reduce and the extruded filling material undergoes resorption over time. Moreover, the fact that the extrusion inside the canal was limited only to the second molar area, and not to the premolar, was considered to be a positive prognostic factor. In the present case report, there was only a limited overfilling but it highlights the dangers of any extruded materials during root canal treatment, especially in proximity to important anatomical areas.

The use of CBCT has recently gained popularity amongst endodontic specialists. The captured CBCT data can reveal additional relevant information about root canal morphology and neighbouring anatomical structures (e.g. the maxillary sinus and mandibular nerve), the true nature and relationship of a periapical lesion to a root and the thickness of the cortical and cancellous plates (Low *et al.* 2008), which cannot be readily obtained from conventional radiographic views. Estrela *et al.* (2008) compared the ability of panoramic and periapical radiographs with CBCT for the detection of endodontic lesions. Their results confirmed the apparent increased sensitivity of CBCT for detecting apical periodontitis.

The CBCT examination exposes the patient to significantly less radiation compared with a CT scan, and it is able to provide detailed three-dimensional images of the tooth, the root canal system and the surrounding tissue. CBCT's major advantage over CT scanners is the substantial reduction in radiation exposure. This is due in part to rapid scan times, pulsed X-ray beams and sophisticated image receptor sensors (Cotton *et al.* 2007, Patel *et al.* 2007).

Conclusion

Cone beam computed tomography can be considered an effective radiographic diagnostic device when endodontic-related inferior alveolar nerve or mental foramen paraesthesia are suspected.

Disclaimer

Whilst this article has been subjected to Editorial review, the opinions expressed, unless specifically indicated, are those of the author. The views expressed do not necessarily represent best practice, or the views of the IEJ Editorial Board, or of its affiliated Specialist Societies.

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