CASE REPORT

Inferior alveolar nerve injury resulting from overextension of an endodontic sealer: non-surgical management using the GABA analogue pregabalin

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Abstract


Aim To describe a case of endodontic sealer (AH Plus) penetration within the mandibular canal after root canal treatment with resolution of pain and paraesthesia after a non-surgical approach, including treatment with prednisone and pregabalin.

Summary A 37-year-old woman underwent root canal treatment of the left mandibular second molar tooth. Postoperative periapical radiographs revealed the presence of radiopaque canal sealer in the mandibular canal. The day after, the patient reported severe pain in the tooth and paraesthesia/anaesthesia in the region innervated by the left inferior alveolar and mental nerve. Diagnosis of injury to the inferior alveolar nerve because of extrusion of AH Plus was established. The non-surgical management included 1 mg kg⁻¹ per day prednisone, two times per day, in a regimen on a daily basis, and 150 mg per day pregabalin, two doses per day, monitoring the progress with periodic follow-up visits. One month after the incident, the signs and symptoms were gone.

Key learning points

• This case illustrates the care required when performing root canal treatment, especially when the root apices are in close proximity to the inferior alveolar nerve canal.
• The complete resolution of paraesthesia and the control of pain achieved in the present case suggests that a non-surgical approach combining prednisone and pregabalin is a good option in the management of the inferior alveolar when it is contacted by extruded root filling material.

Keywords: endodontic complications, endodontic pain, endodontic sealer, inferior alveolar nerve injuries, paraesthesia, pregabalin.

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Introduction

During root canal treatment, overinstrumentation with hand or mechanically driven files can perforate the mandibular canal, allowing the extrusion of endodontic sealers, dressing agents, and irrigant solutions out of the tooth and into the canal (Koseoglu et al. 2006). Although material extrusions that are small are generally well tolerated by the periradicular tissues (Poveda et al. 2006), symptoms such as pain, hyperaesthesia, hypoaesthesia, anaesthesia, dysesthesia and paraesthesia have been reported after the extrusion of endodontic materials into the mandibular canal when in contact with alveolar nerves as a result of the neurotoxicity of their components (Morse 1997, Ahlgren et al. 2003, Gallas-Torreira et al. 2003, Poveda et al. 2006, Froes et al. 2009, González-Martin et al. 2010).

Although there have been no controlled trials of treatment protocols involving endodontically related injuries to the inferior alveolar nerve, the normal therapeutic sequence for this complication is the control of pain and inflammation and, whenever possible, the surgical elimination of the cause (Pogrel 2007). However, total resolution of pain and reduction in or disappearance of paraesthesia after a non-surgical management have been reported (Blanas et al. 2004, Poveda et al. 2006, Froes et al. 2009, González-Martin et al. 2010).

Pregabalin is a gamma-aminobutyric acid (GABA) analogue with similar structure and actions to gabapentin. It has antiepileptic, analgesic and anxiolytic activity. Pregabalin has proven effect in chronic pain (Moore et al. 2009, Ferré-Corominas et al. 2010) and is indicated for the management of neuropathic pain associated with diabetic neuropathy and post-herpetic neuralgia (Zareba 2005). Moreover, pregabalin appears to have significant analgesic properties for acute pain following the third molar extraction (Hill et al. 2001).

The aim of this paper is to describe a case of endodontic sealer (AH Plus) penetration within the mandibular canal after root canal treatment of a mandibular left second molar, with resolution of pain and paraesthesia after a non-surgical approach, including treatment with prednisone and pregabalin.

Case report

A 37-year-old woman was referred to the Dental Clinic of the School of Dentistry, University of Barcelona, Spain, for root canal treatment in the mandibular left second molar tooth because of acute apical periodontitis subsequent to caries (Fig. 1). She neither

Figure 1 Pre-treatment periapical radiograph showing a deep carious lesion.
smoked nor consumed alcohol and had no personal or family disease antecedents of interest. Following anaesthesia and isolation with rubber dam, an endodontic access cavity was prepared. Three canal orifices were defined. After apical patency, working length was determined electronically using the DentaPort ZX (J. Morita Mfg. Corp., Higashihama Minami-cho, Fushimi-ku, Kyoto, Japan) and confirmed radiographically. Root canal preparation was carried out with hand files using the step-back technique and saline irrigation. After cleaning and shaping, the canal was dried and filled with AH Plus (Dentsply DeTrey GmbH, Konstanz, Germany) and gutta-percha using the lateral compaction technique. A small quantity of sealer was introduced into the root canal using a manual instrument, then the main cone was placed and coated with a minimal quantity of sealer and cold compaction was performed. Each additional cone was covered with a small quantity of sealer.

There were no complications during treatment but the postoperative periapical radiograph showed radiopaque canal sealer in the mandibular canal (Fig. 2). The patient was still under the effect of the anaesthetic, and she reported neither pain nor other discomfort. The patient was recalled the day after, and no swelling, redness or other signs of inflammation were observed upon intraoral exploration. Nevertheless, the patient reported severe pain in the treated tooth, numbness on the left side of the lower lip and a tingling sensation in the buccal gingiva between the mandibular central incisor tooth (31) and the second premolar tooth (35). Diagnosis of injury to the inferior alveolar nerve (traumatic nerve lesions, irritation, neuritis) owing to the overextension of AH Plus was established.

Extraoral examination revealed no swelling, alterations in skin colour or adenopathies. The anaesthetized zone was delimited by tactile exploration (Fig. 3), and anaesthesia in the region served by the left inferior alveolar and mental nerve was observed: buccal gingival tissues over the left mandibular second and first premolar teeth felt no sensation; there was no sensation to thermal or mechanical stimuli in either the left lower lip or buccal gingivae. The lingual gingival tissues responded within normal limits to stimulation with an explorer.

After discussing treatment options, the patient refused surgical debridement of the inferior alveolar canal and decompression of the inferior alveolar nerve, and a non-surgical approach was therefore approved. Treatment started with an anti-inflammatory regimen including 1 mg kg$^{-1}$ per day prednisone (Dacortin®; 30 mg; Merck SL, Madrid, Spain) in two doses, in a gradually reducing regimen on a daily basis, and 150 mg per day pregabalin

![Figure 2](image-url) Postoperative periapical radiograph revealing the presence of radiopaque material (endodontic sealer) in the mandibular canal.
(Lyrica®, 75 mg; Pfizer SL, Barcelona, Spain), two doses by day, monitoring the progress with periodic follow-up visits.

The patient noticed a very rapid improvement in the first few days after the incident. One week later, the patient had no pain, and paraesthesia in the region of the lower left lip had decreased. The prednisone was stopped but the pregabalin regimen was maintained. Two weeks later, the paraesthesia was reduced substantially compared with the initial situation (Fig. 4), and so, the pregabalin was stopped. The patient reported a gradual reduction in paraesthesia over the following 2 weeks, and 1 month after the incident, the signs and symptoms were gone.

**Discussion**

Ideally, during the root canal treatment, the filling material should be confined to the root canal. Overextension and/or overfilling of mandibular molar and premolar is a potential iatrogenic cause of inferior alveolar nerve injury (Escoda-Francoli et al. 2007). Severe endodontic pain after endodontic sealer extrusion requires early diagnosis and prompt management to reduce the risk of permanent nerve damage (Froes et al. 2009). Recently,
CBCT has been proposed as an effective radiographic diagnostic device when endodontic-related inferior alveolar nerve or mental foramen paraesthesia is suspected (Gambarini et al. 2011).

Alantar et al. (1991) described four possibilities of endodontic sealer spread to the periapical region: towards the mandibular canal, drainage through lymphatic vessels, systemic diffusion through a periapical vein and progression towards soft tissues between bone and mucosal membrane. The case reported here corresponds with the first of these routes.

The first symptom of overextension into the mandibular canal is sudden pain that occurs during filling of the root canal, which persists after the disappearance of the local anaesthetic (LaBanc & Epker 1984). The pain can be accompanied by local inflammatory signs with the tooth being painful to percussion, painful upon palpation of the buccal alveolar process or a combination of signs of mechanical trauma and inferior dental nerve inflammation with pain or numbness of the lower lip or otalgia (Tamse et al. 1982). Some patients experience persistent anaesthesia (Rowe 1983, Grotz et al. 1998). In the present case, symptoms occurred after 1 day, and pain was associated with paraesthesia.

Accidental extrusion of sealer into the mandibular canal may damage the inferior alveolar nerve by mechanical, thermal or chemical mechanisms (Morse 1997, Fanibunda et al. 1998, Gallas-Torreira et al. 2003). In the case described here, AH Plus extruded into the mandibular canal. AH Plus is a commonly used epoxy resin-based root canal sealer with the monomer 2,2-bis[4-(2-hydroxy-3-methacryloxypropoxy) phenyl]-propane (Bis-GMA), prepared from bisphenol A and glycidyl methacrylate, as its major ingredient (Peutzfeldt 1997). Previous reports have shown that AH Plus can cause cytotoxic effects (Pulgar et al. 2002) and neurotoxicity when extruded into the mandibular canal (González-Martín et al. 2010). Moreover, it has been shown that its component bisphenol A can also cause cytotoxicity (Segura-Egea et al. 1999). The cytotoxic effect of AH Plus has been shown to be dependent on the setting time, showing a significant reduction after 7 days (Miletic et al. 2003). In this case, polymerization of the sealer may explain, at least in part, the rapid improvement observed in the first days after the incident.

Treatment of this endodontic complication remains controversial, varying from a wait-and-see approach, including anti-inflammatory drugs and periodic follow-up (Blanas et al. 2004, Poveda et al. 2006, Froes et al. 2009, González-Martín et al. 2010), to early, if not immediate, surgical debridement of the inferior alveolar nerve involving bone removal of the vestibular cortical plate (Gallas-Torreira et al. 2003, Koseoglu et al. 2006, Escoda-Francoli et al. 2007) or sagittal mandibulotomy (Scolozzi et al. 2004). In the present case, the patient refused the surgical approach, but agreed to attend frequent follow-up appointments. So, a non-surgical management was agreed including anti-inflammatory treatment with prednisone and analgesic treatment with pregabalin.

Pregabalin is an analogue of the inhibitory neurotransmitter GABA. Although its main indication is chronic pain and trigeminal neuropathic pain (Ferré-Corominas et al. 2010, Zakrzewska 2010), it has been frequently used in neuropathic pain (Blommel & Blommel 2007). Pregabalin has shown analgesic activity in preclinical models (Buvanendran et al. 2008, Bender et al. 2009) and appears to have significant analgesic properties following third molar extraction (Hill et al. 2001). Peak plasma levels occur approximately 1 h after oral doses, and oral bioavailability is approximately 90%. Food does not significantly affect the extent of absorption. Pregabalin is not protein bound and exhibits a plasma half-life of 6 h, which is not dose dependent. Hepatic metabolism is negligible, and most of the oral dose (95%) appears unchanged in the urine. Pregabalin is a safe and well-tolerated new treatment for neuropathic pain (Zareba 2005). Taking into account that endodontic sealer extrusion into the mandibular canal damages the inferior alveolar nerve triggering neuropathic pain, the use of pregabalin in the case reported here was justified.
In previous reports (Gallas-Torreira et al. 2003, Koseoglu et al. 2006, Escoda-Francoli et al. 2007, González-Martín et al. 2010), the volume of sealer extruded in the present case seems to be substantially less. This may have been an important factor in the rapid healing response observed in this patient and others where the amount of extruded sealer was also small (Gambarini et al. 2011).

The complete resolution of the paraesthesia and the control of pain achieved in the present case suggests that a non-surgical approach combining prednisone and pregabalin is a good option in the management of inferior alveolar nerve damage subsequent to endodontic sealer extrusion.

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References


