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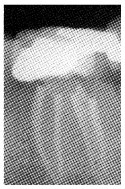
CASE REPORT



CASE REPORT

Sodium hypochlorite accident with evaluation by cone beam computed tomography

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Abstract

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Aim To show the radiographic manifestation of sodium hypochlorite after accidental injection past the apical foramen and into the soft tissues.

Summary A female patient was seen for an emergency visit after suffering a sodium hypochlorite accident at her general dentist's office. The patient was seen within 1 h of the accident and was in pain associated with facial swelling. Radiographs, including a Cone Beam Computed Tomography (CBCT), and photographs were taken. Endodontic emergency treatment was initiated. The patient was reassured and given pain medication and antibiotics. Follow-up visits were scheduled over 6 days when the swelling had resolved.

Key learning points

- Importance of multiple radiographic images during preoperative endodontic evaluation when undertaking endodontic retreatment.
- Knowledge of apical anatomy as related to surrounding structures.
- Effect of sodium hypochlorite when injected in the soft tissues.

Keywords: cone beam computed tomography, sodium hypochlorite.

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Introduction

Sodium hypochlorite (NaOCl) is a commonly used irrigant in root canal treatment offering disinfection and debris removal because of its effective ability to dissolve organic soft tissue because of its powerful oxidation ability (Mentz 1982, Ayhan *et al.* 1999, Mehdipour *et al.* 2007). The disadvantage of NaOCl is that it can cause acute inflammation followed

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by necrosis if it comes into contact with vital soft tissue, causing cellular destruction in all but heavily keratinized epithelium (Nakamura *et al.* 1985, Witton & Brennan 2005). The tissue reaction is more severe with higher concentrations of the solution. However, when the irrigant is confined to the intracanal space, it is no more toxic than saline solution (Gernhardt *et al.* 2004). Sodium hypochlorite accidents have been reported because of accidental injection of the NaOCl stored by the operator in empty anaesthetic carpules (Becker *et al.* 1974, Gernhardt *et al.* 2004). Regardless of the reason, a sodium hypochlorite accident is a frightening event and all caution should be used to prevent it from happening. Fortunately, the incidence of these accidents is rare (Crincoli *et al.* 2008), but it increases when there is pulpal necrosis with a periradicular radiolucency, is more common in maxillary teeth than mandibular teeth and is more common in women than men (Kleier *et al.* 2008). Reports of sodium hypochlorite accident show facial swelling, ecchymosis, profuse bleeding, air emphysema and allergic reactions (Becker *et al.* 1974, Gatot *et al.* 1991, Hales *et al.* 2001, Kleier *et al.* 2008, De Sermeño *et al.* 2009, Motta *et al.* 2009). The prognosis of the tooth involved is not negatively affected by the NaOCl accident (Kleier *et al.* 2008).

No description of the soft tissue effects of hypochlorite accidents using Cone Beam Computed Tomography (CBCT) has been reported.

The objective of this case report is to review and analyse the cause and extent of soft tissue injury caused by a sodium hypochlorite accident using CBCT.

Report of the case

A 32-year-old Caucasian female with no contributory medical history and no known dental allergies reported for a root canal treatment on the left maxillary second premolar by the general dentist 2 h prior to presentation. She reported never noticing an adverse reaction to bleach or any products containing bleach. The general dentist reported 2 mm over-instrumentation of the canal and possible extrusion of 3% sodium hypochlorite solution. Whilst the dentist was irrigating with NaOCl, the patient began to experience severe burning pain. The canal was flushed with saline and continued to drain serous fluid for approximately 15 min. The tooth was temporized with a cotton pellet and temporary cement. When the dentist sat the patient upright, her face began to swell.

On presentation, the patient had severe swelling of the buccal space. A clinical photograph (Fig. 1) and a periapical radiograph (Fig. 2) were taken; the periapical film did not reveal any remarkable findings. CBCT volume was taken with a Kodak 9000; a volume of 3.7 cm height by 5 cm diameter was acquired with 70 kVp and 10 mA. Cone Beam CT images revealed the presence of multiple round or ovoid in shape low-density areas within the soft tissues of the cheek of the patient. These areas showed an air-bubble appearance and were remarkably abundant throughout the soft tissue (Fig. 3). On coronal slices, a

Figure 1 Patient with left-sided swelling.

Figure 2 Periapical radiograph of teeth 24, 25 and 26.

considerably larger low-density area was noted in contact with the buccal cortex superior to the apex of the left maxillary second premolar: 25 (Fig. 4). The bubbles were larger and more numerous closer to the area of NaOCl extrusion and extended throughout the full field of view. The CBCT revealed no perforation of the root. The apex of the canal was

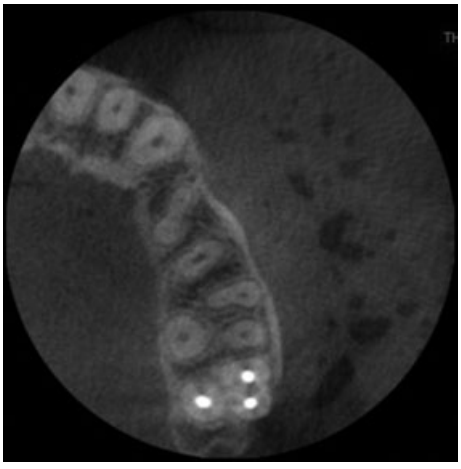

Figure 3 CBCT axial view, note the air bubbles within the soft tissue thickness.

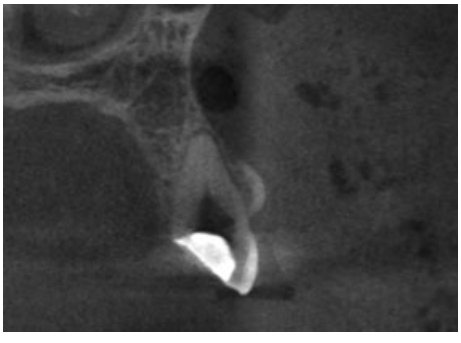

Figure 4 CBCT coronal view: a considerably lower density area is noted on the buccal aspect of the area of interest.

Figure 5 Note the interruption of the buccal plate and the communication of the open apex with the soft tissue lesion.

open and perforated the buccal plate giving the extruded irrigant unimpeded access to the buccal space (Fig. 5).

The patient was anaesthetized with one cartridge of 4% septocaine (1 : 100 000 epinephrine) with buccal infiltration. A 1-cm incision was made and serous fluid was drained from the buccal space. A single 4′0 silk suture was placed after the drainage subsided. No surgical tubing drain was necessary. The swelling was reduced immediately. The patient was prescribed: Clindamycin 300 mg every 6 h for 1 week; hydrocodone and acetaminophen 5/500 q6h as needed for pain; and one methylprednislone (4 mg) dose pack to be taken sequentially over the next 6 days.

The patient was seen on day 2 and swelling was greatly reduced (Fig. 6). The patient's chief complaint that day was tightness of tissue in the cheek area. There was no external appearance of ecchymosis or haematoma. Follow-up at day 6 revealed further reduction in swelling and minimal symptoms (Fig. 7). The patient did not experience bruising of the intraoral or extraoral tissues.

Discussion

It is assumed that in this case, extrusion of the NaOCl solution causes extravasation of the buccal space soft tissue. Pashley *et al.* (1985) showed that 1 : 1, 1 : 2 and 1 : 4 dilutions

Figure 6 Two days following the accident, the swelling was already reduced.

Figure 7 Six days following the accident further reduction of swelling.

of NaOCl caused skin ulcerations and leakage of plasma proteins from the vasculature to the injection site following intradermal injections, proving that extrusion of NaOCl into the periapical tissues can cause severe irritation, oedema, and is cytotoxic. Recommendations include placing a stopper on the needle to prevent placement too far into the canal, not bending the needle, not using excessive force, keeping the needle moving while irrigating, using a side-vented needle, and take working films to ensure correct working length (Kleier *et al.* 2008). In this case, the over-instrumentation of the canal allowed the NaOCl to be extruded to the periapical tissues and could have been prevented if these steps were followed. The best situation would be to have some pre-knowledge of the possibility of sodium hypochlorite sensitivity and take measures to avoid the contact. The questions usually asked in a health history interview are:

Are you sensitive when coming in contact with household bleach?

Are you bothered when swimming in a pool that has chlorine?

Are you allergic to IVP dye? (Intravenous Pyelogram dye contains iodine, a close family member of chlorine on the periodic table of elements). It is mentioned by some authors that this allergy may indicate that the patient is more likely to be allergic to other related substances. (Shehadi 1975, Almén 1994).

If the patient responds by yes to these inquiries, the use of sodium hypochlorite is not indicated in the initial visit and referral for allergy and sensitivity testing before completing treatment is indicated. If the patient is unwilling or unable to undertake testing, then a different irrigation material such as chlorhexidine and/or EDTA (ethylenediaminetetraacetic acid) is indicated. When adverse reactions occur, correct management includes the change of the irrigant solution to prevent additional reactions and to calm the patient, adequate analgesia, prophylactic antibiotic therapy to prevent infections resulting from the damage, and light corticosteroid and antihistamine therapy in selected cases. For the immediate relief of pain, a nerve block with a local anaesthetic should be considered. Cold compresses should be used to minimize swelling in the affected area (Crincoli *et al.* 2008).

The use of the CBCT before root canal treatment of this tooth would have identified these risk factors for a NaOCl accident, that is, buccal fenestration with protrusion of the buccal root into the periosteal space and it could have helped with preoperative length determination. Taking the CBCT after the NaOCl accident was helpful in determining the cause of the accident and allowing quick and effective treatment of symptoms. The contrast resolution and the capacity of differentiating multiple soft tissue density structures with CBCT are limited because of several factors including the low amount of radiation and the use of a surface detector. In this case, the low-density air-bubble shaped areas within the soft tissues of the cheek could have been fluid or air, their density is closest to fluid but this cannot be confirmed. Most probably, they were because of a fulminant inflammatory reaction, but could also be collections or pools of NaOCl within the

soft tissues of the cheek. The drainage of the serous fluid from the buccal tissue provided the patient with immediate relief. The patient was never in extreme pain after the initial visit and only reported mild discomfort because of the tightness of the tissue that was swollen. The CBCT volume is a high-performance imaging tool because it shows the complexity of root canals in three dimensions (Michetti *et al.* 2010). In this case, it was also helpful in determining whether the tooth was restorable and not perforated, without having to reopen the access cavity. This prevented wasted time for both the patient and the endodontist. An accurate three-dimensional reconstruction of the tooth was invaluable for appropriate management of this case.

Disclaimer

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