

## Case Report

# Inadvertent Extrusion of Sodium Hypochlorite during Endodontic Treatment: Case Report

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**OPEN ACCESS****Abstract**

Root canal treatment is an essential part of general dental practice. Sodium hypochlorite (NaOCl) in various concentrations is the most widely used endodontic irrigant, but it can be irritant to vital tissues. This study presents a clinical case of tissue damage related to NaOCl extrusion to the apex during root canal treatment. A 45-year-old woman with moderate pain, dental crown fracture with healthy apex of first upper right premolar, was accepted into clinic for treatment. Pulpar necrosis was diagnosed and root canal treatment was performed. Bruises and severe inflammation of the right side of the face appeared immediately after irrigation and extrusion of NaOCl 5.25%. To avoid this type of accidents it is essential to recognize the signs and symptoms that occur immediately after projection. Also, must be consider it as an operational accident that can be mainly prevented by the use of side exit needles for root canal irrigation and a minimum of 2 mm short of the working length.

**Keywords**

- Sodium hypochlorite
- Hypochlorite accident
- Inadvertent extrusion
- Root canal irrigant

**ABBREVIATIONS**

NaOCl: Sodium Hypochlorite; EDTA: Ethylenediamine-tetraacetic Acid

**INTRODUCTION**

The use of irrigating solutions is an important part of effective chemomechanical preparation. It enhances bacterial elimination and facilitates removal of necrotic tissue and dentine chips from the root canal. Irrigants can prevent packing of the infected hard and soft tissue apically in the root canal and into the periapical area [1]. NaOCl is the most widely used irrigating solution and is used in concentrations varying from 0.5% to 5.25%; it is a potent antimicrobial agent, and effectively dissolves pulpal remnants and organic components of dentine. NaOCl is best known for its strong antibacterial activity; it kills bacteria very rapidly even at low concentrations [1]. It can be deduced from the literature that 2.6% & 5.25% sodium hypochlorite has the unique capacity to dissolve necrotic tissue and the organic components of the smear layer [2].

Irrigation is an essential step during the process of cleaning, disinfection and lubrication of the root canal system and during the previous procedure to its three-dimensional obturation. Irrigation by itself can expel remains of tissue, the smear layer or some foreign material from the tooth. An additional factor is

the movement of agitation generated by ultrasonic scale, and according to studies with electron microscopy when used in alternate way EDTA/NaOCl/EDTA, produced better cleaning and less smear layer [3,4].

NaOCl has been defined by the American Association of Endodontists as a clear, pale, yellowish-green and extremely alkaline liquid that has dissolvent action on necrotic tissue and organic residue, and acts as a potent antimicrobial agent [4]. Hypochlorite has a low surface tension, it is a moisturizer and its lack of biocompatibility may cause severe traumatic injuries in living tissue due its tissue cytotoxic. The results of a recent in vitro study shows that the most effective irrigation regimen is 5.25 % at 10 minutes [5,6].

Poor isolation can allow the extrusion of NaClO to the mucosa and severe complications may occur. If the contact is through conduct, damage will appear in the periapical area and the consequence will be necrosis of adjacent bone and several shocking clinical features: taste of chlorine, severe pain, rapid development of oedema, haemorrhage, haematoma, necrosis, burning sensation, ulcers, paraesthesia, dehiscence, ocular disorders, contractile scars, trismus, secondary infection and abscesses [7,8].

**CASE PRESENTATION**

A 45-year-old female patient healthy at the time of anamnesis

attends for consultation at the National School of Advanced Studies Endodontic Clinic, UNAM Leon, due to crown fracture of tooth 14. After vital tests, pulpar necrosis was diagnosed and root canal treatment was performed. NaOCl 5.25 % was used for irrigation and at the end of the biomechanical preparation of the root canal, it was accidentally and inadvertent extruded to the periapical area. Immediately the patient reported pain, burning sensation and began massive bleeding through conducts. Root canals were abundant washed with sterile saline solution 0.9% (PiSA®, Mexico) during 10 minutes, calcium hydroxide (Viarden, Mexico) was placed into root canals and IRM® (Dentsply, Milford, USA) was used as temporary restoration. Right after, the rubber dam was removed for clinical examination and oedema and ecchymosis in the periorbital, labial, submandibular, zygomatic and genial region was observed, as well the patient referred pain to palpation (Figure 1). The patient was informed of the presence of a NaOCl accident and possible sequelae of it. As drug therapy, ketorolac with tramadol (10 mg/25 mg) was prescribed every 12 hours for 3 days to relieve pain, together with amoxicillin (500 mg) every eight hours for 7 days to prevent bacterial infection. Additionally, the use of cold compresses was indicated.

Three days after the hypochlorite accident, the patient presented sensitivity to vertical and horizontal percussion but a stable interim restoration. The oedema decreased considerably and no mobility was observed, however ecchymosis was more noticeable in the infra-orbital, genial and lip region (Figure 2).

Ten days after the patient attends follow-up appointment and root canal treatment. Clinically showed a slight bruising on the right side (Figure 3), but no pain nor paraesthesia. Radiographically changes were not observed, and root canal treatment was concluded using NaClO 2.5% and biomechanical ProTaper® NiTi rotary instrumentation (Dentsply-Maillefer, Switzerland). For the final procedure, sterile saline solution 0.9% (PiSA®, Mexico) was used for irrigation. Conducts were dried before and after the use of EDTA 17% (Densell, Argentina) during three minutes, and filled and sealed with Hygienic® Gutta Percha points caliber 35 and cement calcium hydroxide-based Sealapex® (SybronEndo, EUA) using a modified ultrasonic side technique (Figure 4).

Thirty days (Figure 5) and six months (Figure 6a) after the accident, patient attended a follow-up clinical examination and radiographic control. Since one month, the patient did not report any sign, symptom or any sequelae from the irrigant solution. An inlay restoration was placed as final treatment (Figure 6b).

## DISCUSSION

Three types of NaOCl extrusion accidents have been reported in the literature: careless iatrogenic injection, extrusion into the maxillary sinus, and extrusion or infusion of NaOCl beyond the root apex into the periradicular regions [9]. The majority of case reports on NaOCl accidents fall into the third category [9]. It is explicable at that time how extrusion of such a small amount of 0.5 ml of NaOCl into the periradicular tissues could have resulted in inflammation and destruction of soft tissues of UN proportional magnitude [10].

In this case, the extrusion of NaOCl beyond the root apex that occurred during root canal treatment was inadvertent. It might



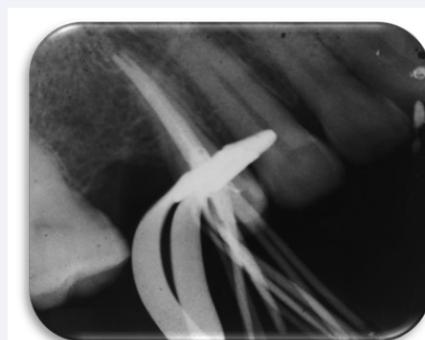
**Figure 1** Clinical examination immediately after hypochlorite accident: Ecchymosis, trismus and bruising in the infra-orbital region.



**Figure 2** Clinical examination at three days after hypochlorite accident; oedema decreased considerably, but still ecchymosis in the right genial and infra-orbital region as well in the lip.



**Figure 3** Ten days after hypochlorite accident.



**Figure 4** Obturation radiography; lateral technique with ultrasonic scale.

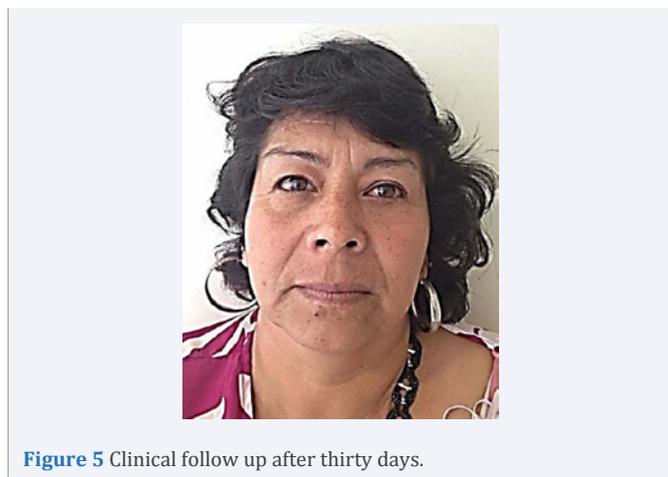


Figure 5 Clinical follow up after thirty days.



Figure 6 Six months follow up (a), final restoration (b).

be possible relate it to a strong pressure during the irrigation that developed a severe acute inflammatory reaction of the tissues. This leads to rapid tissue swelling both intra orally within the surrounding mucosa and extra orally within the skin and subcutaneous tissues [11]. The followed ecchymosis should have been damage to the blood vessels with extravasation of blood into the adjacent subcutaneous soft tissues. The result of haematoma could be associated to bleeding of interstitial tissues [11].

Severity of panfacial involvement that may accompany these classic NaOCl accidents may be classified into four categories [9]:

- I. Oedema only without ecchymosis;
- II. Ecchymosis involving the angle of the mouth and the periorbital;
- III. Ecchymosis involving II and extending extensively into the neck region;
- IV. Ecchymosis involving III and extending into the chest, resulting in Mediastinal ecchymosis.

In this case is category II where is ecchymosis involving the angle of the mouth and the periorbital region. The manifestations are not surprising, as NaOCl is extremely cytotoxic due to its pH=12 and it becomes a dangerous irritant for periradicular tissues during root canal treatment [12].

Spencer et al [11]. Indicate that the initial management to potential minimise the tissue swelling, is the use of cold compression (frozen items wrapped in a towel). For mild to moderate pain may be managed with analgesia, and oral antibiotics may be prescribed to minimise the risk of secondary bacterial infection. Additionally to abundant wash with sterile

saline solution 0.9%, these indications were followed immediately after hypochlorite accident.

It is very important to know the concentration and the volume of the irrigant solution used, due this can help to identify the magnitude of the accident. The recognition of subsequent primary management by the dental practitioner of these complications is essential to ensure best clinical practice [13,14].

In this case report, fortunately the complications were not severe as those compared to Witton and Brennan, who used an unknown concentration hypochlorite solution. The results of extravasation of hypochlorite besides oedematous and ecchymosis, was a limited opening to 20 mm and intra-orally marked necrosis of the upper right labial mucosa, ulceration of the mucosa of the maxillary alveolus and weakness of the buccal branch of the facial nerve [1,15]. On review of one month, the swelling had almost resolved and the patient was pain free. At three months examination, signs of swelling and haematoma were completely gone.

It is important to remark that this case serves as a useful reminder that NaOCl solution should be handled with extreme care. In the unlikely event of a hypochlorite accident, the recognition and subsequent management as cooling packs during first 24 hours, analgesia and antibiotics, and arrange a follow up if to be managed in dental practice, is essential to ensure best clinical practice [11].

Some alternative irrigant to NaOCl that has been used is chlorhexidine gluconate (2%), which has been in use for a long time in dentistry because of its antimicrobial properties, its substantivity, and its relatively low toxicity. Other alternative is ethylenediaminetetra acetic acid (EDTA), it is an effective chelating agent that effectively removes smear layer by chelating the inorganic component of the dentine. Therefore, by facilitating cleaning and removal of infected tissue, contributes to the elimination of bacteria in the root canal. Another irrigant used in endodontics is hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>), particularly popular in cleaning the pulp chamber from blood and tissue remnants. It has also been used in disinfection and canal irrigation, but literature does not support its use over that of other irrigating solutions [1].

To avoid hypochlorite accidents, it must be follow some recommendations as [16,17]:

- 1) Use of special needles (caliber 27) to irrigate the conducts;
- 2) Set the needle at least 2 mm short from working length and during irrigation and use moderate pressure movements of back and forth to prevent the passage of hypochlorite to apical tissues;
- 3) Use safety glasses for the patient and for the dentist to prevent contact of NaOCl with the conjunctiva of the eye;
- 4) Using chlorhexidine gluconate 2% as alternative irrigant after the accident, for the conclusion of the treatment.
- 5) Must give a verbal and writing explanation to the patient of the potential complications that may occur during endodontic therapy to avoid legal repercussions in the future.

## CONCLUSION

Any dentist, who decides to make endodontic treatment,

must have the knowledge for the management of substances used for irrigation of root canals. Although sodium hypochlorite accidents created by extrusion of the irrigant through root apices are relatively rare and are seldom life-threatening, they create substantial morbidity when they occur. It is essential to recognize the signs and symptoms that occur immediately after projection, such as chlorine taste, severe pain, swelling, hematoma, ecchymosis, necrosis, feeling of burn, oedema in neighboring soft tissues or over the injured half side of the face and profuse bleeding from the root canal. Also, must be consider that this type of alteration is considered an operational accident that can be prevented by the use of rubber dam, protective eye-wear, side exit needles for root canal irrigation. Specially an irrigation needle a minimum of 2 mm short of the working length, avoidance of excessive pressure during irrigation, know and implement these recommendations down the accident rate in the root therapy.

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