e-ISSN: 2637-0611

Available online at
https://journal.uitm.edu.my/ojs/index.php/COS

Compendium of Oral Science 13 (1) 2026, 144 - 157

Compendium of Oral Science

Management of Sodium Hypochlorite Accident:

A Trio Series of Case Reports

Afzan Adilah Ayoub[1,2*], Noor Ilyani Othman[1], Wan Nur Farhana Wan Abdul Rahman[1], Noorharliana Mohamed Zohdi[1], Gary Shun-Pan Cheung[2]

[1] *Comprehensive Care Centre of Studies, Faculty of Dentistry, Universiti Teknologi MARA, Sungai Buloh Campus, Selangor, Malaysia*
[2] *Department of Endodontology, Faculty of Dentistry, University of Hong Kong, Hong Kong*

ARTICLE INFO

Article history:
Received 07 July 2025
Revised 09 February 2026
Accepted 19 February 2026
Online First
Published 01 March 2026

Keywords:
root canal treatment
root canal irrigation
sodium hypochlorite
mishaps

DOI:
10.24191/cos.v13i1.7313

ABSTRACT

Sodium hypochlorite (NaOCl) is the most often used solution in root canal treatments due to its inexpensive cost and highly efficient antibacterial activity against diseased root canal microorganisms. Nonetheless, this solution can produce difficulties due to its cytotoxic properties. When this solution is injected into neighbouring tissues, the patient typically experiences excruciating pain, and an immediate therapy is required to prevent long-term complications. This article covers the clinical characteristics of three individuals who sustained unintentional NaOCl extrusion following endodontic treatment of variable severity and different therapies. In addition, it describes the long-term neurologic impairments that this type of accident may produce and suggests a treatment strategy for such cases.

INTRODUCTION

Sodium hypochlorite (NaOCl) was introduced by Coolidge in 1919 and has maintained as a popular dental irrigant (Sonarkar et al., 2018). Sodium hypochlorite is well known for its cost effectiveness (Clarkson *et al.* 1998), bactericidal effect (McComb *et al.* 1975; Türkün *et al.* 1997), availability (Frais *et al.* 2001), ability to provide lubrication during instrumentation (Abou-Rass *et al.* 1982), and to flush out loose debris (Baumgartner *et al.* 1992). It is able to dissolve necrotic organic materials on direct contact (Haapasalo *et al.* 2010) but is irritant to vital tissues (Mentz 1982). NaOCl have a broad-spectrum antibacterial activity. It can kill spore-forming and vegetative bacteria, fungi, protozoa and viruses (hepatitis A and B,HIV, HSV-1 and HSV-2) in a short time (Rutala *et al.* 1997).

1,2* Corresponding author. *E-mail address:* afzan_adilah@uitm.edu.my

Although NaOCl has been widely used, till now there is no consensus concerning the ideal concentration for clinical endodontic application. Numerous *in vivo* and *in vitro* studies have been done in evaluating the effectiveness of different concentrations of NaOCl (Abou-Rass et al. 1982; Baumgartner et al. 1992; Clarkson et al. 1998; Frais et al. 2001). Regardless of the concentration, any extrusion of the solution into the periapical tissues will result in detrimental consequences.

Mishandling of NaOCl for root canal irrigation may range from damage to patient's clothing, splashing of the irrigant into patient's or operator's eye, extrusion beyond the apical foramen and air emphysema. Several mild to severe incidents have been reported when NaOCl is inadvertently forced into the periapical tissues (Hülsmann et al. 2000; Serper et al. 2004; de Sermeño et al. 2009). Apical extrusion of the solution occurred because of faulty working length (Becker et al. 1974), iatrogenic widening of the apical foramen (de Sermeño et al. 2009), wedging of the irrigating needle or perforation (Hülsmann et al. 2000) and anatomical variation of the tooth treated (Klier et al. 2008). In some cases, sodium hypochlorite was mistakenly injected as local anaesthesia that has led to visual blurring, soft tissue necrosis and persistent paraesthesia, respectively (Gursoy et al. 2006). A recent systematic review concluded the need for uniform data reporting to help a more systematic identification of the causes of NaOCl incidents, as well as the prevention, management and prognosis (Guivarc'h et al., 2017a).

In this paper, three cases involving the accidental extrusion of NaOCl are discussed.

Case Report 1

An 84-year-old Chinese female was referred as an emergency, for a sudden onset of burning sensation and swelling on the left side of the face near the infra-orbital region. The symptoms appeared during root canal treatment of the maxillary left canine at the undergraduate clinic. The patient had a complex medical history including a history of angina, hypertension, thyroidectomy, seizure, pancreatic pseudocyst, gallstone, chronic gastritis, hypercholesterolaemia, sinusitis and prone to fainting. She also presented with cervical spondylosis causing her discomfort in supine position. She was on medication for thyroid disease, hypertension and seizure. She had no known drug allergy and a non-smoker. She was a resident at an elderly home-care centre and claimed to have no parafunctional habit.

The endodontic therapy of tooth 23 was performed under rubber dam isolation, and the root canal was irrigated with 3% NaOCl. During instrumentation, the patient developed a sudden, excruciating pain and a swelling at the left suborbital region. NaOCl accident was suspected and the patient was referred to Endodontic postgraduate clinic.

Upon referral, her face presented with mild swelling and redness especially at the left infra-orbital region extending to the left upper lip. There was no clicking, tenderness to palpation and deviation upon opening and closing her temporomandibular joints. No lymphadenopathy was detected in submental, submandibular and crevicular regions. The tooth 23 presented with a temporary filling. It was tender to palpation and percussion. There was no sinus tract and gingival swelling. Periodontal probing depth and mobility were within normal limits. Radiographically, widening of the periodontal membrane space was noted. A working diagnosis of pulp necrosis, previously initiated therapy with normal apical tissues complicated with sodium hypochlorite extrusion was established.

https://doi.org/10.24191/cos.v13i1.7313

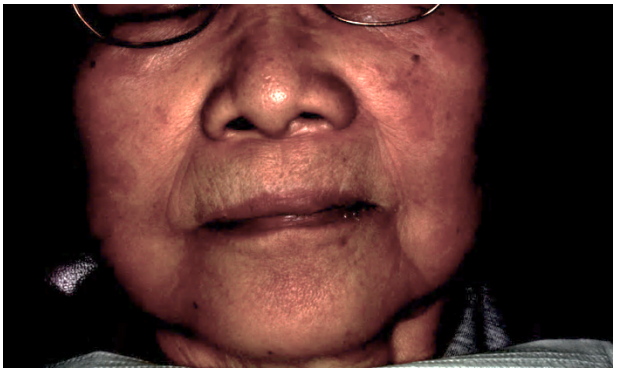


Fig. 1 Clinical appearance related to extravasation of the sodium hypochlorite solution during endodontic treatment, with swelling and redness of the left side of the face. These symptoms appeared during root canal treatment of the upper left canine.

Management of sodium hypochlorite accident

On examination, it was observed that the patient had difficulty in opening her left eye (Fig 2). The swelling had extended to the upper lip. There was an altered sensation at the infraorbital area and the region of the upper left lip to the left lip corner. No paraesthesia of the dental nerves was reported, and there was no obvious ecchymosis upon assessment. Before referral to the postgraduate student, she was given additional local infiltration anaesthesia at the region which caused the pain to gradually subside. On clinical examination, the tooth, which was temporarily cemented on the palatal surface, was slightly sensitive to vertical and horizontal percussion. The periapical radiograph showed no periapical radiolucency but widening periodontal space. After the clinical examination, the patient's general health was evaluated to ensure there was no contraindication with the medication prescribed. It was suggested that she continued to consume her prescribed medications along with the antibiotics (C. Amoxycilin 250mg tds) which was given for three days. No additional analgesic was prescribed as patient already taking aspirin and Dologesic daily. The patient was discharged. She was seen again three days and one week later. On both appointments, the swelling and redness had reduced and no paraesthesia was noted. The patient did not complain of pain despite feeling slight discomfort on palpation at the left infra-orbital region. The root canal treatment was successfully completed by a postgraduate student.

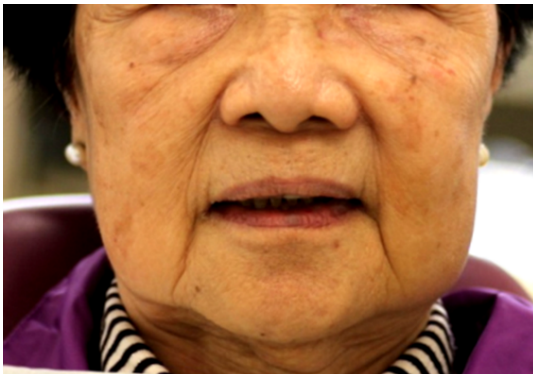


Fig. 2 Facial view 3 days after the sodium hypochlorite accident

https://doi.org/10.24191/cos.v13i1.7313

Treatment details

Non-surgical root canal treatment of tooth 23 was performed under local anaesthesia with Xylestesin-A® (2% lignocaine with 1:80,000 adrenalines), rubber dam isolation and magnification from a dental operating microscope.

Non-surgical root canal treatment of 23

Access cavity was redefined after removal of temporary dressing. Chlorhexidine (0.2%) was used to irrigate the canal to avoid further complication. The working length for the canal was measured with an electronic apex locator (Root ZX Apex Locator, J Morita Corporation, Kyoto, Japan) and confirmed with a periapical radiograph. Patency was established with a size 10 K-file and the canal was prepared by using the step down technique (Goerig et al., 1982). The master apical file size of the canal was 40.

(a) (b) (c) (d)

Figure 3. Radiographic sequence of root canal treatment for tooth 23
(a) Pre-operative periapical radiograph of tooth 23 showing widening of the periodontal ligament space prior to endodontic treatment
(b) Working length determination of tooth 23 confirmed using apex locator and periapical radiograph.
(c) Master cone radiograph demonstrating appropriate fit of gutta-percha prior to obturation.
(d) Post-operative radiograph of tooth 23 following root canal obturation.

Non-setting calcium hydroxide (Calasept®) was used as intra-canal medicaments. All inter-appointment temporization was carried out with a cotton-pellet, Cavit®, and IRM®. The canal was obturated with gutta-percha and AH Plus sealer using warm vertical compaction technique. Fiber post (size 2) was cemented with Rely X Unicem. Tooth 23 was restored with composite resin, and a post-operative radiograph was taken. At this time, the swelling and redness had fully resolved. Patient was discharged to the referring operator for definitive coronal restoration of 23.

Prognosis Review

Patient was seen again 3 months after the complication. She reported of slight discomfort on palpation on left infra-orbital region and no paraesthesia was associated. The tooth was not tender to palpation or percussion. There was no sinus tract noted. Periodontal probing depths around tooth 23 were 3 mm or less and no mobility was associated with the tooth. The prognosis of the tooth was considered good.

https://doi.org/10.24191/cos.v13i1.7313

Fig. 4 Facial view of the patient three months after sodium hypochlorite accident showing complete resolution of swelling and ecchymosis in the left infraorbital region.

Case Report 2

A 64-year-old, Caucasian man was referred for the management of tooth 22. Root canal treatment for tooth 22 had been initiated by an undergraduate student 6 months earlier. A perforation was suspected when sodium hypochlorite accident happened during canal preparation. A radiograph with gutta percha inserted into the canal confirmed the perforation (Fig.5.).

The patient had experienced two episodes of myocardial infarctions and a history of surgical repair of hernia. He was a chronic alcoholic for 30 years and sober for 20 years. He was on Aspirin, Inhibace, Simvastatin, Atenolol. He was not a regular dental attendee and smoked cigarettes 20 sticks/day.

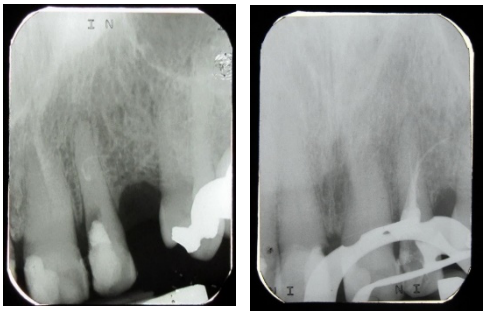
Generally, the patient presented with poor oral hygiene with heavily restored dentition. There were presence of teeth with caries, abrasion, attrition and pus from labial gingival of 22. Tooth 22 was restored with GIC restoration (palatal). It was firm and not tender to percussion.

Nonsurgical root canal treatment of 22

Non-surgical root canal treatment of tooth 22 was performed under local anaesthesia with Xylestesin-A® (2% lignocaine with 1:80,000 adrenalines), rubber dam isolation and magnification from a dental operating microscope. Following removal of temporary restoration, canal patency was achieved with Kfile #08. Coronal flaring and thorough irrigation with NaOCl performed. Patient suddenly felt pain and had teary eye (L). Ice pack placed on left cheek to ease pain, blood pressure 130/78, pulse 70bpm were recorded. As the patient's complexion turned greyish, an oxygen support was given. He was immediately sent to the hospital via ambulance.

On the next day, the patient presented with a swelling on left cheek with the size of a golf ball. He was not in pain and not taking painkillers. Ten days after the accident, patient felt no pain associated with tooth 22, but slight numbness around cheek and lips. Intraorally, there was presence of sinus at buccal sulcus. He was advised to rinse with warm salt water and treatment plan discussed. Patient agreed to extract tooth 22. Three weeks later, sinus was still present at buccal sulcus of 22. However, the patient reported no pain and the numbness had fully resolved.

https://doi.org/10.24191/cos.v13i1.7313



(a) (b)

Fig. 5 Radiographic findings of tooth 22.
(a) Referral periapical radiograph showing gutta-percha inserted into the canal to confirm the suspected perforation. The tooth presented with one straight root noted with curvature of apical ¼ towards distal
(b) Pre-operative periapical radiograph showing the presence of extruded intracanal medicament from perforation site and periapical radiolucency.

Case Report 3

A 49-year-old healthy Chinese lady was treated at the Endodontic Postgraduate clinic for the removal of threaded prefabricated metal post and retreatment of tooth 11 due to an unsatisfactory greyish margin of the previous crown. The tooth was diagnosed with previously treated, asymptomatic apical periodontitis. Retreatment was carried out on tooth 11 under local anaesthesia and dental dam isolation. Direct operating microscope (DOM) were used throughout the treatment. After the removal of metal post using ultrasonic instrument, and partial removal of the previous gutta-percha (GP) using H-File size 20# and gp solvent, patient complaint of sudden sharp excruciating shooting pain under the nostril area with visual analogue scale of (9/10). NaOCl extrusion accident was suspected.

There was no working length determination as the operator was uncertain if all the gutta-percha had been removed. The incident occurred during the first attempt of irrigation using 2.5% NaOCl (0.6 ml) using a 5 ml syringe and a 30G side-vented needle with a positive pressure method. The estimated working length according to the pre-op radiograph was 25.0 mm. However, the pre-op radiograph was taken with intact post and core. Thus, the operator assumed the estimated working length without radiograph after post removal was 20.0 mm. As a precaution for irrigation, the 30G side-vented needle was bent at 17.0 mm. Unfortunately, the working length was 17.5mm when determined using apex locator and checked with radiograph on the next visit during post 1 week of sodium hypochlorite accident review session.

After 30 minutes of incidents, ecchymosis noted on the right lower eye lid area and intraoral labial sulcus adjacent to tooth 11 apical area. No ulceration intraorally and no bleeding from the canal noted (Fig 10). The management of sodium hypochlorite accident was managed accordingly (Guivarc'h et al., 2017b).The management was multidisciplinary involving two departments: Endodontic Department and Oral Maxillofacial Surgery (OMFS) Department.

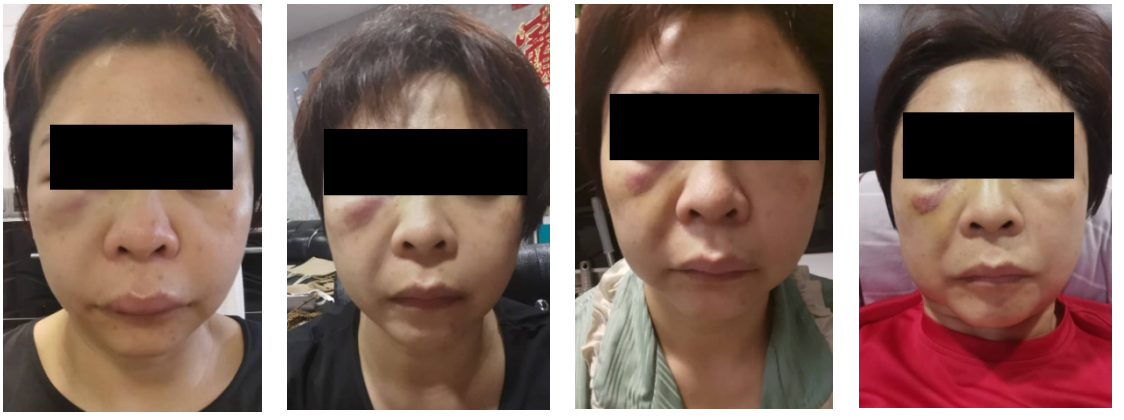
https://doi.org/10.24191/cos.v13i1.7313

Fig 6. Extraoral photograph showed bruising noted on lower right eyelid region after 30 minutes of incident.

The endodontic management by the operator were as follows: a) stop irrigation procedure, b) Informed supervisor/superior, c) Flushed canal with copious saline (pain score reduced, VAS 5/10),d) T.Paracetamol 1g stat was given.

Right infraorbital and right upper lip started swelling and bruising after few minutes' incident, these was followed by cold compression followed by warm compression on the affected area around 30 minutes. Operator opted to defer remaining procedure and placed temporary crown. The operator was advised to refer the patient to OMFS department.

At OMFS clinic, Hydrocortisone 200mg IM given, Arcoxia 90mg oral 1-tablet stat together with C. mefenamic acid 500mg tds 5/7 and T. Augmentin 625mg bd 5/7 was prescribed to the patient. Patient was reviewed by both disciplines after a week. She was recommended to take medication accordingly and complete the course of antibiotics. Reassurance was given.



(a) (b) (c) (d)

Fig 7. Sequential clinical photographs showing the progression of facial ecchymosis and swelling in the infraorbital region following the sodium hypochlorite extrusion accident (a) Day 1 after the incident (b) Day 2 (c) Day 3 (d) Day 4

https://doi.org/10.24191/cos.v13i1.7313

Continuous review after the NaOCl extrusion accident was done and retreatment of tooth 11 was continued and completed followed by placement of fiber post and E-max crown.

Review after one week, the ecchymosis was still present on infraorbital area (1cmx1cm) and on tooth 11 buccal sulcus area. Slight tender on palpation of lower nostril area VAS (4/10) pain score, spontaneous tingling sensation on the right nasal area for a few seconds more than 5x a day. Investigations and examinations were done to check for any risk of irrigant extrusion after post-removal: No perforation, fracture, or crack was noted. Working length was 17.5mm when determined using apex locator and checked with radiograph. Suspected extruded needle irrigation penetration beyond apical constriction causing the sodium hypochlorite extrusion accident.

After 3 weeks of incident, patient came to continue retreatment of tooth 11. Chlorhexidine was used as irrigant of choice after the accident occurred. However, during the final irrigation protocol before obturation after 1 month of incident, 2.5% NaOCl was also used with precautions. Thus, retreatment of tooth 11 was completed after 1 month of NaOCl accident. A review was conducted at 8th months. Patient asymptomatic with intact E-Max crown.

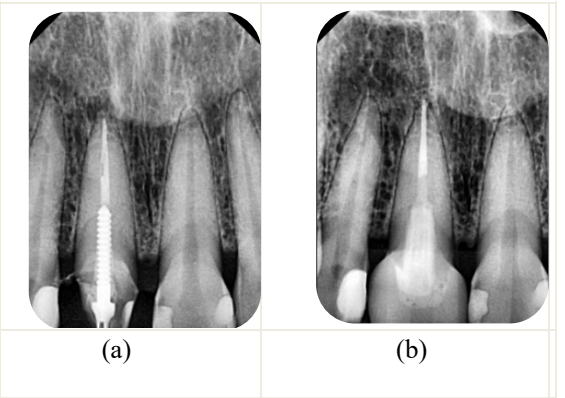


Fig. 8. Radiographic appearance of 11 (a) Pre-op periapical radiograph prior to retreatment (b) Eight-month follow up radiograpgh showing satisfactory outcome after completion endodontic retreatment and definitive restoration.

Discussion

In general, the immediate reactions of a 'hypochlorite accident' are excruciating sharp pain, rapidly increasing swelling, profuse bleeding both interstitially and into the tooth (Hülsmann and Hahn 2000a) and occasional sloughing of overlying mucosa and bone (Becker, Cohen, and Borer 1974a; Sabala and Powell 1989a). Some reports have described severe edema (Sabala and Powell 1989b) and appearance of ecchymosis (Witton et al. 2005), followed by tissue necrosis (Pontes et al. 2008), secondary infection, ulceration (Othman 2022)and in some situation, prolonged paraesthesia (Hülsmann and Hahn 2000b; Witton et al. 2005) and airway obstruction. Interestingly, in one classical case where there was no deleterious manifestation was reported except for the bitter taste of sodium hypochlorite (Ehrich, Brian Jr, and Walker 1993).

Sodium hypochlorite accident is managed by informing the patient about the occurrence and what can be expected and severity of complication, controlling pain either by local anaesthesia or prescribing analgesics and review for recovery control in sequel. Prescribing antibiotics is not mandatory except for cases with high risk or any evidence of secondary infection(Guivarc'h et al. 2017b). Hulsmann *et al.* (2000) suggested that the swelling should be treated by cold compresses on the first day. After the first day, these should be replaced by warm compresses and warm mouth rinses to stimulate the local microcirculation. For severe

https://doi.org/10.24191/cos.v13i1.7313

cases, hospitalization and administration of intravenous steroid may be necessary. Corticosteroid can suppress post-operative pain and oedema (Salvadori et al. 2022). Corticosteroid has been prescribed in several case reports (Salvadori et al. 2022; Witton et al. 2005). Other case reports on sodium hypochlorite did not mention corticosteroid in their sodium hypochlorite accident management, yet include antihistamine (Becker, Cohen, and Borer 1974b), decongestant (Ehrich et al. 1993), analgesics (Becker et al. 1974b; Hülsmann and Hahn 2000b; Sabala and Powell 1989b), antibiotics (Becker et al. 1974b; Hülsmann and Hahn 2000b; Sabala and Powell 1989b), additional local anaesthesia(Sabala and Powell 1989b), apical trephination and rubber drain(Sabala and Powell 1989b) and cold compresses (Guivarc'h et al. 2017b; Sabala and Powell 1989b).

The patient should be informed that healing will take some days, weeks or months, and that symptoms in most cases will resolve completely. After the acute symptoms have resolved, endodontic treatment may be completed. The use of mild non-irritating irrigants such as chlorhexidine digluconate is recommended (Basrani and Haapasalo 2012; Hülsmann and Hahn 2000c; Qutieshat et al. 2023). Operator should be more careful and judious during sodium hypochlorite irrigation.

In this first case report, patient experienced excruciating pain and rapid increasing swelling during a chemo-mechanical debridement of tooth 13 by an undergraduate. The patient was calm despite the pain she had. From the conversation with the undergraduate student, the needle was believed to be inadvertently wedged in the canal during debridement procedure. Before the referral, the patient was given additional local anaesthesia infiltration on the region. The pain subsided gradually. She was prescribed antibiotics in consideration of possible secondary infection.

This patient is considered high risk and may manifested secondary infection as she was diagnosed with multiple medical disorder: angina, high cholesterol level, hypertension, pancreatic psedocyct, gallstone, chronic gastritis, sinusitis, cervical spondylosis and easily fainting. The patient was taking aspirin and Dologesic. Therefore, analgesic was not prescribed. Several medications that had been prescribed to the patient were believed to contradict the effect of corticosteroid if prescribed. Those medications are aspirin, Nifidipine, Methyldopa, calcium carbonate, Senna, and Perindopril tertbutylamine. The drug interactions of corticosteroid and her medications range from mild to severe side effect such as fatigue, laxative effect, myalgia, hallucination, impaired sight, abdominal distension etc. Thus, corticosteroid was also not prescribed.

Accidental perforation of the roots or pulp chamber floor is a serious complication of endodontic and restorative procedures. This perforation may occur during nonsurgical root canal therapy or during the preparation for a variety of restorative procedures (Tsesis and Fuss 2006). Chronic inflammation of the periodontium (characterised by the formation of granulation tissue) can resul t in irreversible loss of attachment or tooth loss (Al-Daafas and Al-Nazhan 2007). These perforations are treated surgically or non-surgically, based on the specifics of each case(Roda 2001). The prognosis of a lesion arising at the radicular furcation may be uncertain. However, if the issue is accurately detected and treated with a material that possesses appropriate sealing capacity and biocompatibility, the prognosis is often favourable (Tsesis and Fuss 2006). The prognosis is based upon factors such as the lesion's location, size, and duration of contamination.

Iatrogenic perforations can arise from various factors, such as anomalous canal morphology, errors made by practitioners during pulp chamber access, deficiencies in chemical and mechanical preparation resulting in scarce wear of canal walls, calcifications, or preparation for intracanal post placement. These perforations may be attributed to practitioner negligence, recklessness, or lack of experience. Consequently, numerous scholars have endeavoured to investigate alternate approaches that enhance the safety of equipment to reduce the incidence of iatrogenic perforation(Gorni et al. 2016; Gulabivala and Ng 2023).

https://doi.org/10.24191/cos.v13i1.7313

Perforations occurring in the furcation or cervical third of the root have a detrimental effect on the prognosis of endodontic treatment. These perforations elicit an inflammatory response in the periodontal zone, which can result in attachment loss and, in some cases, tooth loss. The formation of a periodontal pocket can be influenced by the crestal bone level and the extent of its damage at the site of perforation. Following the destruction of the alveolar bone, there is a high probability of granulation tissue formation, which may subsequently invaginate into the tooth via the perforation tract (Othman 2022).

In the second case report, patient requested for extraction. Inadvertent injection of sodium hypochlorite beyond the apical foramen may occur in teeth with wide apical foramina or when the apical constriction has been destroyed during root canal preparation or by resorption. It can also be caused by a man-made foramen ie. perforations during cleaning and shaping. Additionally, extreme pressure during irrigation or binding of the irrigation needle tip in the root canal with no release for the irrigant to leave the root canal coronally may result in contact of large volumes of the irrigant to the apical tissues. If this occurs, the excellent tissue-dissolving capability of sodium hypochlorite will lead to tissue necrosis just like in the present case.

A classical case report by Becker *et al*. (1974) was very similar to the present case whereby after wedging the irrigation needle in the root canal, sodium hypochlorite was forced beyond the apex of a maxillary right cuspid which led to immediate strong reactions with extreme pain. Then, the patient's cheek and upper lip showed signs of haematoma and ecchymosis inferior to the right zygoma and profuse haemorrhage from the root canal. Wet compresses were continuously applied to relieve the pain and the burning sensation felt by the patient. According to Becker *et al*. (1974) although the swelling increased during the next few hours, the pain slowly diminished.

The third case occurred due to failure of operator establishing working length determination before inserting the irrigation needle. This mistake led to extrusion of irrigation needles beyond apical region thus to the mis-unfortunate accident. By empowering ourself with the mechanics of typical NaOCl accident, clinicians are more aware of informed decisions especially during the delivery and improved the safety and efficiency of NaOCl usage ((Wan et al., 2024).

This case series demonstrates varied presentations and management outcomes of NaOCl extrusion. Case 1 involved a high-risk elderly patient with medical comorbidities who responded well to conservative management. Case 2 presented with root perforation and required extraction. Case 3, a relatively healthy individual, experienced neurological symptoms but achieved full recovery after multidisciplinary management. These differences highlight the importance of individualized risk assessment and prompt intervention.

Case	Age/ Gender	Key Risk Factors	NaOCl concentration	Management	Outcome
1	84/F	Multiple comorbodities	3%	Antibiotics, conservative care	No paresthesia at 3 months
2	64/M	Perforation, heavy smoker	Unknown	Extraction	Resolved with residual sinus at 3 weeks and fully healed after 6 months
3	49/F	Post-removal mishap	2.5%	Steriods, antibiotics	Full recovery at 8 months

https://doi.org/10.24191/cos.v13i1.7313

Conclusion

The endodontic literature contains several case reports on complications during root canal irrigation, including inadvertent injection of NaOCl or hydrogen peroxide into the periapical tissues, air emphysema, and allergic reactions to the solutions. Most of the cases occurred because of incorrect determination of endodontic working length, iatrogenic widening of the apical foramen, lateral perforation, or wedging of the irrigating needle. Clearly, precautions must be undertaken to prevent such complications. The patient's clothing should be protected effectively against the irrigant, as well as the patient's and operator's eyes. The irrigating needle must be fixed to the syringe and must not be wedged into the root canal.

From all three case reports, it is obvious that the location of the perforation, needle estimation before insertion and precautions are crucial information. During irrigation a low and constant pressure should be used and all excess irrigant leaves the root canal coronally via the access cavity with the help of a high-speed suction. Root perforations are common complications of endodontic treatment or post preparation and may lead to tooth extraction(Alshehri et al. 2024). Successful treatment depends mainly on immediate sealing of the perforation and prevention of infection. Several factors determine the achievement of these goals, most important of which are: time of occurrence, size, and location of the perforation. Prevention of NaOCl extrusion remains paramount. This includes careful working length determination, use of side-vented needles, passive irrigation with minimal pressure, and patient risk assessment. These three cases underscore the importance of clinical vigilance, timely intervention, and personalized treatment strategies.

ACKNOWLEDGEMENTS/FUNDING

We would like to acknowledge Faculty of Dentistry, Universiti Teknologi MARA (UiTM) for supporting this research.

CONFLICT OF INTEREST STATEMENT

The authors agree that this research was conducted in the absence of any self-benefits, commercial or financial conflicts and declare the absence of conflicting interests with the funders

AUTHORS' CONTRIBUTIONS

Afzan Adilah Ayoub, Noor Ilyani Othman and Wan Nur Farhana contributed to the conception of the work,data acquisition and manuscript drafting. All three authors are involved in data interpretation and manuscript revision. **Noorharliana Mohamed Zohdi and Gary Shun-Pan Cheung** supervised the project and provided critical academic input throughout manuscript development. All authors approved the final manuscript.

REFERENCES

Abou-Rass, Marwan, and Michael V Piccinino. 1982. 'The Effectiveness of Four Clinical Irrigation Methods on the Removal of Root Canal Debris'. *Oral Surgery, Oral Medicine, Oral Pathology* 54(3):323–28. https://doi.org/10.1016/0030-4220(82)90103-7

Al-Daafas, Abdullah, and Saad Al-Nazhan. 2007. 'Histological Evaluation of Contaminated Furcal Perforation in Dogs' Teeth Repaired by MTA with or without Internal Matrix'. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology* 103(3):e92–99. doi:10.1016/j.tripleo.2006.09.007

Alshehri, Maram M., Bushra F. Alhawsawi, Atheer Alghamdi, Salem O. Aldobaikhi, Maha H. Alanazi, Fahad A. Alahmad, and Maram M. Alshehri Jr. 2024. 'The Management of Root Perforation: A Review of the Literature'. *Cureus* 16(10). DOI: 10.7759/cureus.72296

Basrani, Bettina, and Markus Haapasalo. 2012. 'Update on Endodontic Irrigating Solutions'. *Endodontic Topics* 27(1):74–102. https://doi.org/10.1111/etp.12031

Baumgartner, J. Craig, and Paul R. Cuenin. 1992. 'Efficacy of Several Concentrations of Sodium Hypochlorite for Root Canal Irrigation'. *Journal of Endodontics* 18(12):605–12. https://doi.org/10.1016/S0099-2399(06)81331-2

Becker, Gerald L., Stephen Cohen, and Ronald Borer. 1974a. 'The Sequelae of Accidentally Injecting Sodium Hypochlorite beyond the Root Apex: Report of a Case'. *Oral Surgery, Oral Medicine, Oral Pathology* 38(4):633–38. https://doi.org/10.1016/0030-4220(74)90097-8

Ehrich, Daniel G., J. Daniel Brian Jr, and William A. Walker. 1993. 'Sodium Hypochlorite Accident: Inadvertent Injection into the Maxillary Sinus.' *Journal of Endodontics* 19(4):180–82. https://www.jendodon.com/article/S0099-2399(06)80684-9/fulltext

Erkal, Damla, Yunus Emre Çakmak, Ana Maria Pistol, and Kürşat Er. 2025. 'Pulp Tissue Dissolution Capacities of Two Hypochlorite-Based Irrigants at Different Temperatures: An in Vitro Study'. *BMC Oral Health* 25(1):1104. https://doi.org/10.1186/s12903-025-06516-y

Frais, S., Y-L Ng, and K. Gulabivala. 2001. 'Some Factors Affecting the Concentration of Available Chlorine in Commercial Sources of Sodium Hypochlorite'. *International Endodontic Journal* 34(3):206–15. https://doi.org/10.1046/j.1365-2591.2001.00371.x

García-Torres, Edgar. 2025. 'Sodium Hypochlorite in Endodontic Therapy: Immutable Hero or Imminent Threat?' *Odovtos International Journal of Dental Sciences* 27(1):12–15. http://dx.doi.org/10.15517/ijds.2024.60339

Goerig, Albert C., Robert J. Michelich, and Howard H. Schultz. 1982. 'Instrumentation of Root Canals in Molar Using the Step-down Technique'. *Journal of Endodontics* 8(12):550–54. https://www.jendodon.com/article/S0099-2399(82)80015-0/fulltext

Gorni, Fabio G., Anita Andreano, Federico Ambrogi, Eugenio Brambilla, and Massimo Gagliani. 2016. 'Patient and Clinical Characteristics Associated with Primary Healing of Iatrogenic Perforations after Root Canal Treatment: Results of a Long-Term Italian Study'. *Journal of Endodontics* 42(2):211–15. https://doi.org/10.1016/j.joen.2015.11.006

Guivarc'h, Maud, Ugo Ordioni, Hany Mohamed Aly Ahmed, Stephen Cohen, Jean-Hugues Catherine, and Frederic Bukiet. 2017a. 'Sodium Hypochlorite Accident: A Systematic Review'. *Journal of Endodontics* 43(1):16–24. https://doi.org/10.1016/j.joen.2016.09.023

Gulabivala, Kishor, and Yuan Ling Ng. 2023. 'Factors That Affect the Outcomes of Root Canal Treatment and Retreatment—A Reframing of the Principles'. *International Endodontic Journal* 56:82–115. https://doi.org/10.1111/iej.13897

Haapasalo, Markus, Ya Shen, Wei Qian, and Yuan Gao. 2010. 'Irrigation in Endodontics'. *Dental Clinics* 54(2):291–312. https://doi.org/10.1016/j.cden.2009.12.001

Hülsmann, Michael, and Wolfram Hahn. 2000a. 'Complications during Root Canal Irrigation–Literature Review and Case Reports'. *International Endodontic Journal* 33(3):186–93 https://doi.org/10.1046/j.1365-2591.2000.00303.x

Karaś, Bartłomiej, Agnieszka Kotela, Marzena Laszczyńska, Zuzanna Majchrzak, Mateusz Trafalski, Jacek Matys, and Maciej Dobrzyński. 2025. 'Effect of Endodontic Irrigants on the Cyclic Fatigue Resistance of Nickel–Titanium Rotary Instruments: A Systematic Review'. *Materials* 18(17):4056. https://doi.org/10.3390/ma18174056

McComb, Dorothy, and Dennis C. Smith. 1975. 'A Preliminary Scanning Electron Microscopic Study of Root Canals after Endodontic Procedures'. *Journal of Endodontics* 1(7):238–42. https://doi.org/10.1016/s0099-2399(75)80226-3

Mentz, T. C. F. 1982. 'The Use of Sodium Hypochlorite as a General Endodontic Medicament'. *International Endodontic Journal* 15(3):132–36. https://doi.org/10.1111/j.1365-2591.1982.tb01265.x

Othman, N. I. 2022. 'Hypochlorite Accident through Perforation: A Sequence of Iatrogenic Accidents'. *J Dental Health Oral Res* 3(1):1–7. https://doi.org/10.46889/jdhor.2022.3103

Pearson, Michael, Samuel Stewart, Linda Ma, Karl Kingsley, and Victoria Sullivan. 2025. 'Differential Antimicrobial Effects of Endodontic Irrigant Endocyn on Oral Bacteria'. *Hygiene* 5(1):11. https://doi.org/10.3390/hygiene5010011

Pontes, F., H. Pontes, P. Adachi, C. Rodini, D. Almeida, and D. Pinto Jr. 2008. 'Gingival and Bone Necrosis Caused by Accidental Sodium Hypochlorite Injection Instead of Anaesthetic Solution'. *International Endodontic Journal* 41(3):267–70. https://doi.org/10.1111/j.1365-2591.2007.01340.x

Qutieshat, Abubaker, Nutayla Al Harthy, Shima Al Busaidi, Ahmed Al Sadoon, Dima Al Sayahien, Maryam Sedqi, Sumaiya Al Rashdi, and Samiya Al Ghammari. 2023. 'Antimicrobial Irrigation Solutions in Root Canal Treatment: A Glance at the Past, the Present, and the Future'. *The Open Dentistry Journal* 17(1). https://doi.org/10.2174/18742106-v17-230621-2023-5

Roda, Robert S. 2001. 'Root Perforation Repair: Surgical and Nonsurgical Management.' *Practical Procedures & Aesthetic Dentistry: PPAD* 13(6):467–72. https://europepmc.org/article/med/11544819

Rukshana, Ahmed, and Ahmed Suwayda. 2025. 'Exploring the Efficacy of Hypochlorous Acid as a Cost Effective Environmental Decontaminant in Dentistry: A Scoping Review'. https://hdl.handle.net/10566/20830

Rutala, William A., and David J. Weber. 1997. 'Uses of Inorganic Hypochlorite (Bleach) in Health-Care Facilities'. *Clinical Microbiology Reviews* 10(4):597–610. https://doi.org/10.1128/cmr.10.4.597

Sabala, Clyde L., and Steven E. Powell. 1989a. 'Sodium Hypochlorite Injection into Periapical Tissues'. *Journal of Endodontics* 15(10):490–92. https://doi.org/10.1016/s0099-2399(89)80031-7

Salvadori, Matteo, Giuseppe Venturi, Paolo Bertoletti, Jacopo Francinelli, Riccardo Tonini, Maria Luisa Garo, and Stefano Salgarello. 2022. 'Sodium Hypochlorite Accident during Canal Treatment: Report of Four Cases Documented According to New Standards'. *Applied Sciences* 12(17):8525. https://doi.org/10.3390/app12178525

Sonarkar, Snehal S., Shishir Singh, Rajesh Podar, Gaurav Kulkarni, and Rucheet Purba. 2018. 'An in Vivo Comparison of the Antibacterial Efficacy of Photoactivated Disinfection, Diode Laser, and 5% Sodium Hypochlorite in Root Canal Disinfection'. *Journal of Conservative Dentistry: JCD* 21(2):205. https://doi.org/10.4103/jcd.jcd_227_17

Tsesis, Igor, and Z. V. I. Fuss. 2006. 'Diagnosis and Treatment of Accidental Root Perforations'. *Endodontic Topics* 13(1):95–107. https://doi.org/10.1111/j.1601-1546.2006.00213.x

Wan, Nur Farhana, Nurul Ain Ramlan, and Noorharliana Mohamed Zohdi. 2024. 'Borneo Journal of Medical Sciences'. https://doi.org/10.51200/bjms.v18i2.5065

Witton, R., K. Henthorn, M. Ethunandan, S. Harmer, and P. A. Brennan. 2005. 'Neurological Complications Following Extrusion of Sodium Hypochlorite Solution during Root Canal Treatment'. *International Endodontic Journal* 38(11):843–48. https://doi.org/10.1111/j.1365-2591.2005.01017.x

Xie, Wanrong, Meiyi Pan, Zhen Li, and Jinzhi Zhu. 2025. 'A Review on the Efficacy of Ultrasonic and Laser-Activated Sodium Hypochlorite Irrigation at Different Concentrations in Root Canal Treatment'. *Advances in Precision Medicine* 10(2):19–26. https://doi.org/10.18063/apm.v10i2.867

About the Authors

Afzan Adilah Ayoub is an endodontist at the Faculty of Dentistry, Universiti Teknologi MARA (UiTM), with interests in clinical endodontics and management of endodontic complications.

Noor Ilyani Othman is an endodontist affiliated with the Faculty of Dentistry, Universiti Teknologi MARA (UiTM), involved in clinical endodontic practice and case-based research.

Wan Nur Farhana Wan Abdul Rahman is an endodontist at the Faculty of Dentistry, Universiti Teknologi MARA (UiTM), with interests in endodontic diagnosis and management of clinical complications.

Noorharliana Mohamed Zohdi is a restorative dentistry specialist at the Faculty of Dentistry, Universiti Teknologi MARA (UiTM), with experience in clinical practice and research supervision.

Gary Shun-Pan Cheung is a Professor of Endodontics with extensive experience in clinical endodontics, research supervision, and dental education.