Clinical Update

Prevention, Identification, and Management of Sodium Hypochlorite Accidents
LT Kyle Nelson, DC, USN, LCDR Andrea Lisell, DC, USN and CAPT Terry Webb, DC, USN

Introduction
Extrusion of sodium hypochlorite (NaOCl) outside the root canal and its consequences is known as a “sodium hypochlorite accident.” Knowing how to prevent and manage NaOCl accidents is essential for all dentists providing endodontic therapy. The purpose of this Clinical Update is to provide information to aid in the prevention, identification, and management of this stressful clinical mishap.

Sodium Hypochlorite
NaOCl (also known as bleach) is the most commonly used irrigating solution in endodontics today. Due to its antibacterial nature and the ability to dissolve vital and necrotic tissue, it is a very effective irrigant. It also acts as a lubricant and flushes debris from the canal system. However, it is not without its drawbacks. When NaOCl contacts vital tissue, an acute inflammatory reaction occurs followed by necrosis. All tissue, except heavily keratinized epithelium, is susceptible to cellular destruction. Dentists must be aware that damage can occur not only to periapical tissue, but also oral mucosa, eyes, and skin. NaOCl can also cause paresthesia and anesthesia when the accident is in close proximity to neural tissue. Extrusion into the maxillary sinus can also occur due to the close proximity of the maxillary posterior teeth apices to the sinus membrane or frank protrusion into the sinus with pneumatization.

Risk Factors
The majority of NaOCl accidents are iatrogenic in nature. In a survey of 314 Diplomates by the American Board of Endodontics, 42% had experienced at least one NaOCl accident. Improper irrigation technique, wedging of irrigation tip and/or the use of too much pressure, can lead to extrusion of NaOCl. Iatrogenic perforations created during treatment, resorption, immature apices, and root fractures can all increase the risk for extrusion of NaOCl. Anatomic factors also need to be considered, such as root apices in close proximity to maxillary sinus, nerves, and osseous fenestrations. Guivarc’h and others reported an increased prevalence of NaOCl accidents in females (44/52) and the maxilla (41/52). This greater risk in the maxilla is due to the decreased density of the bone and the root apex proximity to the cortical bone and soft tissue. A thorough clinical and radiographic exam can assist in identifying potential risk factors prior to initiating treatment to help minimize NaOCl accidents.

Prevention
A dental dam should always be used during endodontic procedures for asepsis and to minimize inadvertent contact of endodontic irrigants with adjacent tissues. Proper dental dam placement however, does not reduce the risk of NaOCl accidents. NaOCl toxicity increases with concentration. However, using a lower concentration will not prevent NaOCl accidents, but it may reduce the severity of the patient’s symptoms if a NaOCl accident does occur. Even with the increase in toxicity, the benefits outweigh the risks and providers should use full strength NaOCl in most endodontic cases. If potential risk factors that increase the likelihood of a NaOCl accident have been identified (i.e. resorption, perforation, open apex), the risks and benefits of using lower NaOCl concentrations or an alternate irrigant should be considered.

The most commonly used irrigation technique is the conventional syringe and irrigation tip using positive pressure. A side vented irrigation tip, such as a Max-i-Probe®, placed 1 mm short of working length should be used in this technique. At 1 mm short of working length, the irrigant will reach working length. While using a gentle delivery force, keep the irrigation tip passive & moving within the canal. Vinothkumar and others reported a side vented tip removed significantly more bacteria from the canal when compared to a standard hypodermic needle. The use of a side vented irrigation tip creates an upward turbulent flow around and just beyond the tip, minimizing apical extrusion of the solution.

A newer technique of irrigation delivery utilizes negative pressure. One system that utilizes this irrigation method is the EndoVac™. It utilizes a delivery/evacuation tip attached to a syringe and high volume suction. Irrigant is delivered to the apex by placing a cannula into the canal and negative pressure pulls the irrigant to the apical portion and exits through the cannula by way of the high volume suction. EndoVac™ has been shown to extrude significantly less NaOCl than other irrigation techniques, even when used at full working length. One study reports it debrides the canal significantly better at 1 mm from the apex when compared to other irrigation methods. Negative pressure irrigation is effective and may prevent NaOCl extrusion, but is costly compared to traditional positive pressure irrigation methods.

Prevention of a NaOCl Accident
Always use dental dam to avoid inadvertent contact with tissue
Use side vented irrigation tip, passively in the canal
Irrigate using slow, non-forceful pressure
Irrigate at least 1 mm short of WL
Use negative pressure irrigation when available

Identification
Recognition of the clinical signs of a NaOCl accident is important to help minimize tissue damage and facilitate the management of the incident. A triad of signs/symptoms, that are pathognomonic of a NaOCl accident, are sudden pain, profuse bleeding in the canal and direct pain in the tissue despite adequate anesthesia, immediate swelling. A systematic review of 52 NaOCl accidents reported severe pain in 45 cases, 17 had profuse hemorrhaging through the canal, and 49 had swelling. Clinical signs can be different if the maxillary sinus is involved. Patients can experience a burning sensation, NaOCl taste, drainage through the nostrils, a bleach smell, sinus congestion, and nose bleeds. Patients can also experience ophthalmologic symptoms that include eye pain, burning sensation, and vision blurring. In two of the cases, patients...
experienced life-threatening airway obstruction due to swelling in the submental and sublingual spaces. Other symptoms, that may manifest hours or days after the accident, include mucosal or bone necrosis, sensory or motor defects, trismus, and ecchymosis.

Common Signs and Symptoms of a NaOCl Accident

- Severe pain/burning sensation (immediate)
- Profuse bleeding (through canal)
- Swelling
- Ecchymosis
- Bleach taste or smell

Management

Although no standardized guidelines exist, there are published recommendations for the management of a NaOCl accident. The patient should be informed of the accident, the cause, and the signs & symptoms they may experience during the typical course of events. Providers should assess the severity of the accident and refer to an appropriate echelon of care, if warranted, i.e. oral surgery, EMS, or Emergency Department (ED). Immediate management should include canal irrigation with sterile saline to help dilute the NaOCl and allow for bleeding. Manage the patient’s pain with block anesthesia and analgesics. Cold compress application to the affected area for the first 24 hours, then warm compresses thereafter, should help minimize swelling. Both should be applied in 15 minute intervals. In the previously reported systematic review, 45 cases were prescribed an antibiotic, where penicillin was the drug of choice, and 28 were prescribed an oral steroid. There was no consensus on the type, dosage, or frequency of the steroid prescribed. The most common recommended analgesics were acetaminophen and ibuprofen. In cases involving the maxillary sinus, a decongestant may also be prescribed. The patient should be informed that complete healing will take days or even weeks. Daily patient follow-ups should occur until symptoms warrant less frequent follow-ups, and should continue until all symptoms resolve. Thorough documentation of the NaOCl accident, the initial treatment performed, the course of events, and the subsequent evaluations should be recorded in the patient’s dental record.

Management of a NaOCl accident

1. Inform patient of cause, symptoms, and course of events
2. Irrigate with sterile saline
3. Allow bleeding through the canal
4. Pain Control: nerve block, analgesics
5. Prescriptions: analgesics, antibiotics, steroids, and/or decongestants
6. Compresses: cold <24 hrs, warm >24 hrs (15 min intervals)
7. Referral to oral surgeon or ED for evaluation (if necessary)
8. Daily recalls until symptoms resolve

Conclusions

NaOCl is a very effective, but potentially harmful endodontic irrigant if care is not taken. With the use of a dental dam, establishing an appropriate working length, and proper armamentarium and irrigation technique, providers can minimize NaOCl accidents. If a NaOCl accident does occur, early recognition is important in order to manage the situation appropriately. Patient reassurance, dilution with saline, medications, and compresses should be effective in most cases, and in extreme or questionable cases, consultation/referral should occur.

References


LT Nelson is a first-year endodontic resident, LCRD Lisell is a staff endodontist and CAPT Webb is Chairman of the Endodontics Department at the Naval Postgraduate Dental School, Bethesda, MD.

The views expressed in this article are those of the authors and do not necessarily reflect the official policy or position of the Department of the Navy, Department of Defense, or the U.S. Government.