Unintentional Injection of Sodium Hypochlorite Instead of Procaine for a Dental Nerve Block
Ross Sullivan1; Michael Hodgman1; Richard Hall2
1Upstate New York Poison Center, SUNY Upstate Medical University, Syracuse, NY, USA
2Department of Oral & Maxillofacial Surgery, SUNY Buffalo, Buffalo, NY, USA

Introduction
Sodium Hypochlorite is routinely used as an endodontic irrigant and cleanser.1,3 Although rare, sodium hypochlorite accidents can lead to serious and life threatening complications. We report a medication administration error that occurred as a result of a common dental procedure with significant patient injury.

Case
A 35 year old female underwent a routine root canal procedure without complication. At completion of the root canal her dentist proceeded to fill several dental carries as well. The dentist inadvertently used a syringe containing 5.4% sodium hypochlorite instead of procaine when performing an inferior alveolar block. The patient experienced immediate pain and the procedure was terminated. The patient presented to the Emergency Department (ED) 1 hour later with progressive pain and swelling to her left face and lateral neck (Figure 1). The patient had no stridor or difficulty swallowing but complained of progressive facial pain and increased oral secretions. The ED was able to confirm the exposure with the dental office. She received pain medication, steroids and antibiotics in the ED as well as cool compresses and was admitted to the ICU for close observation for signs of airway compromise.

Over the next several days, the patient had increased swelling of her face and lateral neck, and edema developed over her manubrium. A mild change of voice was noted as was left cheek paresthesia. The patient continued to have progressive edema, with necrosis and hemorrhage of the buccal mucosa (Figures 2 and 3).

The patient remained an inpatient for 15 days, and Burn and Oral Maxillofacial Surgical consults were obtained. The patient continued to receive steroids, antibiotics, pain medicine, warm compresses (cold compresses being recommended thereafter to increase blood flow and promote healing) and topical natural product (Hamamelis virginiana extract). Over 25 cases of injury associated with the use of NaOCl are reported in the literature. Most include:

• Immediate pain to the buccal mucosa instead of intended anesthetic used similar-looking syringe
• Immediate pain to right cheek, soft tissue necrosis, lip paresis and paresthesia, right eye visual impairment
• Treatment is mainly supportive and includes:
  - Analgesics, steroids and antibiotics
  - Antibiotic treatments
  - Antihistamines
  - Hydrocortisone
  - Occlusive dressings

• Common reasons cited for dental NaOCl mishaps:
  - Provider carelessness and use of incorrect irrigation needles/syringes (using the same needles/syringes as used for anesthetics)
  - Use of higher NaOCl concentrations (>0.5%) also increases the risk of an adverse event as well14,15
  - Recommendations (in addition to proper root canal technique) to decrease NaOCl accidents:
    - Slow irrigation with low pressure, with passive needle placement to insure no intra mucosal injection
    - Avoiding putting NaOCl in anesthetic cartridges/syringes and use only rubber/plastic needles for NaOCl
    - Reducing the concentration of NaOCl (use 0.5%)

• Treatment is mainly supportive and includes:1,2,3
  - Emergency Medicine ABC’s (Airway, Breath-sounds, Circulation)
  - Analgesics, steroids and antibiotics
  - Cold Compresses are recommended for the first day to decrease the spread of NaOCl, with warm compresses being recommended thereafter to increase blood flow and promote healing
  - Surgical debridements and procedures may be indicated, especially when large amounts of necrotic tissue are present

Discussion
• Sodium hypochlorite possess properties that are favorable for endodontic procedures; these include:
  - Ability to dissolve necrotic tissue debris in canal as well as antimicrobial properties1,3
  - Lubricating properties
  - Inexpensive, readily available, and easy to use
  - Effective concentrations range from 0.5% to 5.25%2,4,8

• Disadvantages of NaOCl use:
  - Acute inflammation followed by necrosis can result when NaOCl comes into contact with vital tissue
  - With higher concentrations of NaOCl (5.25%), hemolysis is well documented, occurring due to its cytotoxic effect4,12
  - NaOCl has a pH of 11 to 12.5. The alkaline property enhances its tissue penetration causing deep and extensive tissue damage (liquefaction necrosis)
  - Over 25 cases of injury associated with the use of NaOCl are reported in the literature. Most injuries occur at injection into the root canal apex. These injuries most often are associated with NaOCl concentrations greater than 0.5%
  - Common symptoms include:
    - Immediate severe pain with early edema
    - Profuse apical/periapical hemorrhage
    - Most symptoms resolve within several days of treatment (see below)
  - There are multiple additional cases of accidents extending beyond the root canal apex, with unique injuries (Table 1)

• Common reasons cited for dental NaOCl mishaps:
  - Provider carelessness and use of incorrect irrigation needles/syringes (using the same needles/syringes as used for anesthetics)
  - Use of higher NaOCl concentrations (>0.5%) also increases the risk of an adverse event as well14,15
  - Recommendations (in addition to proper root canal technique) to decrease NaOCl accidents:
    - Slow irrigation with low pressure, with passive needle placement to insure no intra mucosal injection
    - Avoiding putting NaOCl in anesthetic cartridges/syringes and use only rubber/plastic needles for NaOCl
    - Reducing the concentration of NaOCl (use 0.5%)

• Treatment is mainly supportive and includes:1,2,3
  - Emergency Medicine ABC’s (Airway, Breath-sounds, Circulation)
  - Analgesics, steroids and antibiotics
  - Cold Compresses are recommended for the first day to decrease the spread of NaOCl, with warm compresses being recommended thereafter to increase blood flow and promote healing
  - Surgical debridements and procedures may be indicated, especially when large amounts of necrotic tissue are present

Conclusion
Toxicologists need to be aware of the use of sodium hypochlorite in dentistry. Its (NaOCl) use is fraught with potential dangers which may lead to extensive injury. Toxicologists may be called upon to provide management recommendations when these errors occur.

References: Available upon request.