

Complication of improper management of sodium hypochlorite accident during root canal treatment

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Abstract

Sodium Hypochlorite (NaOCl) is a common irrigation solution used in root canal treatment. It has strong antibacterial and tissue dissolving properties. Nevertheless, it has some serious complications, some of which are life-threatening. A young male presented with severe chemical burn of the right infraorbital area and partial necrosis of the hard palate resulting from extrusion of NaOCl during root canal treatment of the upper right 2nd molar tooth. The patient had a facial scar, and mucosal damage healed nearly completely. Several precautions must be taken during NaOCl use to prevent the spread of the solution into surrounding tissues. Early recognition of NaOCl accident and proper immediate management are important to achieve the best possible outcome.

Key words: Endodontic, Hulsmann criteria, root canal, sodium hypochlorite

INTRODUCTION

Root canal treatment, or endodontic treatment, is a procedure frequently done to debride and disinfect the root canals of teeth. Certain chemicals have been found to be effective in disinfecting the root canal system with different success rates.

Sodium hypochlorite (NaOCl) is a common chemical disinfectant and irrigant used as an adjunct to mechanical debridement. It was used as a wound irrigant in 1915 and became the most popular irrigation solution in endodontics. It was also used during World War I to cleanse contaminated wounds.^[1]

NaOCl is the most effective, inexpensive, readily available chemical.^[2] It is considered to be the most optimal irrigant for use throughout instrumentation

because it possesses potent antimicrobial and proteolytic activity.^[3] It is used to remove the debris and smear layer that forms on instrumented dentin surfaces. In addition, it acts as a lubricant.^[2] With a pH of 11–13, it causes injury primarily by the oxidation of proteins and it can dissolve necrotic and vital pulp tissue, killing a broad range of pathogens.^[3]

The proper concentration of NaOCl remains controversial. However, the effective concentration ranges from 2.6% to 5.25%, although it has been proven that a concentration over 0.5% is cytotoxic.^[3,4] At high concentrations, NaOCl causes hemolysis, ulceration, inhibition of neutrophil migration, damage to endothelial and fibroblast cells, facial nerve weakness, and necrosis after extrusion during endodontic treatment.^[4]

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CASE REPORT

A 24-year-old Caucasian male was referred from a dental clinic to the plastic surgery clinic complaining of a right facial burn after having a root canal treatment 2 weeks back. Data concerning the history was obtained from the patient himself and his medical documents. The lesion was on the right cheek measuring 5 × 5 cm, erythematous, and tender. It was associated with numbness of the skin on the right side of his face. Necrosis of the hard palate was noted. There was blackish hard discharge from his nose [Figures 1-3].

Two weeks ago, the patient underwent a root canal treatment of the upper right 2nd molar tooth at a dental clinic. He was informed about the risks and complications of the procedure. During the root canal treatment, 2.6% NaOCl was used for irrigation and disinfection. The solution was injected mechanically using a syringe. However, the syringe gauge was not documented. A rubber dam was fixed around the tooth, and NaOCl was injected in the pulp cavity. Immediately after injection, the patient suffered from severe burning pain on the inner aspect of his right cheek. The patient developed dizziness and shortness of breath and was treated immediately.

At the plastic surgery department, the patient was treated as a case of chemical burn with creams and ointments. He was followed-up and did not require any surgical intervention. The patient however ended up with discoloration on his right face. The hard palate necrosis healed completely after 6 weeks.

DISCUSSION

Inadvertent injection of NaOCl beyond the apical foramen is uncommon and is infrequently reported in the literature. This complication occurs in teeth with wide apical foramina or when the apical constriction is destroyed during root canal preparation. In addition, extreme pressure during irrigation may result in contact of large volumes of the irrigant with the apical tissues. If this occurs, the excellent tissue-dissolving capability of NaOCl will lead to tissue necrosis.^[4] Alternatively, other tools such as passive ultrasonic irrigation (PUI) could be used, with better outcome in removing debris and less apical extrusion.^[5]

The sequence of signs and symptoms that occurs after extrusion of NaOCl into the periapical tissues, seems to follow a typical pattern. According to Hulsmann's criteria, the diagnosis of NaOCl accident includes the



Figure 1: Day 2, showing the chemical burn on the right cheek



Figure 2: Day 7, showing the necrosis of the palate



Figure 3: Day 30, showing marked improvement of the lesion

following: (1) acute pain, swelling, and redness; (2) bruising; (3) progressive swelling involving the infraorbital area or mouth angle depending on the site of NaOCl injection; (4) profuse hemorrhage

often manifesting intraorally from the orifice of the tooth; (5) numbness or weakness of the facial nerve; and (6) secondary infection, sinusitis, and cellulitis.^[4,6] In the case presented, the patient developed typical presentation of NaOCl accident, with acute pain, swelling, echymosis, and paresthesia. The majority of cases have shown complete resolution within couple of weeks^[7] whereas a few were marked by long-term paresthesia or scarring.^[8]

Proper management of NaOCl accident is important to achieve the best outcome. However, there are no recognized guidelines for the treatment of NaOCl accidents.^[9] The main goal of treatment is to eradicate the solution and to prevent secondary damage with conservative management.

Early recognition of signs and symptoms of NaOCl accident is very important. As mentioned earlier, pain, edema, and redness are the first signs of NaOCl accident. Time is a crucial factor in reducing the destructive effect of NaOCl. Some cases have shown that the edema produced secondary to the inflammatory response could compromise the airway leading to life-threatening events.^[4,9] Using other tools for irrigation, such as PUI, may reduce the risk of such accidents.^[5]

Treatment should point at the principles of reducing swelling, controlling pain, and preventing secondary infection. Immediate irrigation with normal saline is a key step to reduce tissue damage. Tissue contact with NaOCl should be minimized by allowing the solution and exudates to filter out through the root canal orifices. Local and oral analgesics may be helpful to alleviate pain. External compression along with cold packs on the affected area is advised to relieve discomfort and reduce edema. After about 6 hours, cold packs must be replaced by warm compresses for several days. Steroid may be used to minimize edema. Antibiotics might be needed to prevent secondary infection. In more serious cases, referral to a medical center or furthermore surgical intervention may be necessary.^[6]

To prevent NaOCl accidents, radiographic imaging should be done prior to any root canal treatment. Precise evaluation of the length and integrity of individual canals is essential.^[6] The patient and the treating dentist should protect their eyes and clothes effectively against the irrigant. A rubber dam should be used to prevent any leakage or contact of the solution to the soft tissue.^[10,2] Other preventive measures include placing the irrigation needle 1–3 mm short of working

length, permitting free movement of the needle within the canal, and using low constant pressure while injecting the solution.^[3] Using Luer Lock needles with side-port delivery can also help prevent NaOCl accidents.^[3]

CONCLUSION

NaOCl is a highly effective irrigant used for root canal treatment. Nevertheless, it has its own potential side effects, which can be life-threatening. It is, therefore, vital to know how to prevent such hazardous accidents.

In case of accidents, early signs and symptoms including acute pain, swelling, and redness should be noted to prevent further destructive effects of NaOCl and to minimize secondary complications. Airway compromise is the most life-threatening complication, and there should be a high index of suspicion to intervene at early stages.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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