

A Review : Sodium Hypochlorite (NaOCl) Accident Between Diagnosis And Management

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Abstract : Endodontic treatment is a multi-phases procedure, we use a lot of materials and instruments during performing it. One of these important phases is the irrigation including all its benefits and errors during insertion inside the root canal system. This review will be about the properties of sodium hypochlorite, toxicity, prevention and management of sodium hypochlorite accident.

Keywords: Accident, toxicity, Chlorine, Edema, Irrigant, Profuse bleeding.

Date of Submission: 25 -08-2017

Date of acceptance: 09-09-2017

I. Introduction

A large number of endodontically treated teeth are associated with intraradicular bacterial infection. This is an important factor that affects the endodontic treatment outcome (1). The root canal system is complex and includes many accessory anatomical features such as fins, lateral canals and intracanal communications (2). In the infected root canal these locations are potential sites where bacterial colonization could take place. Some bacteria will be killed by chemo mechanical preparation whilst others are killed indirectly by interfering with their nutritional supply. The goals of irrigation in endodontic treatment are mechanical, chemical, and biologic. The mechanical and chemical objectives are flushing out debris, lubricating the canal, dissolving organic and inorganic tissue, and preventing the formation of a smear layer during root canal preparation or dissolving it once it has formed (3). The mechanical effectiveness will depend on the ability of irrigation to generate optimum streaming forces within the entire root-canal system. NaOCl is the most commonly used irrigating solution. It is the irrigant of choice in endodontics, due to its effectiveness against pathogenic organisms and pulp digestion, and satisfies most of the preferred characteristics of root canal irrigant (4). The extrusion of sodium hypochlorite beyond the apex will cause undesirable signs, we call this procedural error 'Sodium hypochlorite accident'.

II. Sodium Hypochlorite Properties

2.1. Advantages of NaOCl :

- Mechanical flushing of debris from the canal.
- dissolving vital (5) and necrotic tissue (6).
- Antimicrobial action (7): that the resistant microorganism, *Candida Albicans*, was killed in vitro in 30 seconds by both 5% and 0.5% NaOCl (8).
- lubricating action (9).
- NaOCl is inexpensive and available (10).
- It has low viscosity allowing easy introduction into the canal architecture.
- Acceptable shelf life.
- It possesses bleaching and lubricating properties.

2.2. Disadvantages of NaOCl :

- Unpleasant taste (11, 12).
- Cytotoxicity when injected into periradicular tissues (11,12).
- Inability to remove smear layer because of its lack of effect on inorganic material (11,12).
- The poorer antimicrobial effectiveness of NaOCl in vivo than in vitro.
- Foul smell(13).

- Ability to bleach clothes (13).
- Ability to cause corrosion of metal objects (13).
- It does not kill all bacteria (14).
- It does remove all of smear layer (15).
- It alters the properties of dentin (16).

2.3. Mode of action:

When sodium hypochlorite contacts tissue proteins peptide links are fragmented and proteins disintegrate, permitting hydrogen in the amino groups (-NH-) to be replaced by chlorine (-NCl-) forming chloramines; this plays an important role for the antimicrobial effectiveness. Because the action of the irrigant is related to the amount of free chlorine, an increase in volume can compensate for a decrease in concentration. NaOCl is used in concentrations varying from 0.5 to 7%. Sodium hypochlorite reacts with fatty acids and amino acids in dental pulp resulting in liquefaction of organic tissue (17).

2.4. Toxicity :

The antibacterial and tissue dissolving action of NaOCl increase with its concentration, but this increase its toxicity. Solution warmers are available to increase the temperature up to 60°C. Increasing the temperature of a solution of sodium hypochlorite improves the bactericidal and pulp dissolution activity, although the effect of heat transfer to the adjacent tissues is uncertain (18).

III. Sodium hypochlorite accident:

If NaOCl is extruded beyond the apex, severe accidents may occur. It is important to know the symptoms and act accordingly. After an accident with NaOCl, the following can be expected:

- Severe pain: Sudden onset of pain is a hallmark of tissue damage, and may occur immediately or be delayed for several minutes or hours (19).
- Edema of neighboring soft tissues, possible extension of edema over the injured half of face and upper lip (20).
- Profuse bleeding from root canal, profuse interstitial bleeding with hemorrhage (20) of skin and mucosa (ecchymosis).
- Chlorine taste and irritation of throat after injection into maxillary sinus, secondary infection.
- Involvement of the maxillary sinus will lead to acute sinusitis (21).
- Chemical burns (22) and tissue necrosis.
- Paraesthesia and anaesthesia affecting the mental (23), inferior dental (23), and infraorbital branches (23, 24) of the trigeminal nerve. Normal sensation may take many months to completely resolve (23, 24).
- Facial nerve damage (19).
- Allergic reactions (30).

3.1. Prevention

Extrusion of NaOCl into periapical tissues can cause severe injury to the patient. To minimize NaOCl accidents, the dentist should follow these recommendations:

- A good proper straight line access cavity design with adequate coronal preparation.
- Preoperative Periapical radiographs to access the root and canal anatomy.
- Clinician must investigate thoroughly the presence of any predisposing risk factor that might lead to development of NaOCl accident such as perforations, resorption, immature apices or any other conditions (25).
- The use of irrigation tips with side venting (Luer Lock needle) reduces the possibility of forcing solutions into the periapical tissues (26).
- The irrigating needle should be placed short of the working length (27), fit loosely in the canal and the solution must be injected using a gentle flow rate (27). Constantly moving the needle up and down during irrigation prevents wedging of the needle in the canal and provides better irrigation.
- The use of negative pressure irrigation system such as EndoVac system (28).
- The use of NaOCl irrigation to the coronal 2/3 of the root with open apex (29).
- The needle is bent slightly at the appropriate length or a rubber stopper is placed on the needle.

3.2. MANAGEMENT

- Unfortunately, low level evidences are available for the management of sodium hypochlorite accident complications such as expert opinion or case reports. Thus, there is no standard treatment protocol has been

documented; this could be because these complications are rare and sporadic.

- Usually conservative and palliative management of NaOCl accident is advocated (31). However, treatment will be determined by the severity of the case (32).
- The patient should be fully informed when a NaOCl accident occurs, and found out the possible etiology.
- Treatment should focus on the principles of minimizing swelling, controlling pain and preventing secondary infection.
- Pain control is very important; local anesthesia or oral analgesics may be helpful to relief pain. Long acting local anesthetic and analgesic such as non-steroidal anti-inflammatory drugs and paracetamol. Flexible prescription by alternating ibuprofen and paracetamol at four hours interval might be effective for severe pain management (33). (Adult doses of paracetamol 1 g qds and ibuprofen or ibuprofen 400 mg qds).
- External compression with cold packs to the local area is recommended to alleviate discomfort and minimize edema. Cold packs should be replaced by warm compresses for several days (34).
- Antibiotics may be needed to prevent the possibility of secondary infection (34). (Amoxicillin 250 mg tds or Metronidazole 200 mg tds in the penicillin allergic patient).
- Administration of dexamethasone is effective in minimizing postoperative pain and swelling after endodontic therapy or flare-up cases (35).
- In the cases of maxillary sinus involvement it might be necessary to drain the sinus surgically (21). if the sinus doesn't become congested, irrigation of the sinus through the root canal using distilled water or saline might be enough (25).
- The precise details of the event should be documented including concentration and volume of the hypochlorite solution involved.

IV. Conclusion

Big attention must be drawn to the risks of the use of NaOCl as an irrigant for root canal irrigation. Thus, it is important to carry out an effective technique in order to avoid complications. In case of accidental extrusion of NaOCl, treatment guidelines should be applied according to the magnitude of each individual case.

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*Mazen Doumani. "A Review: Sodium Hypochlorite (NaOCl) Accident Between Diagnosis And Management." *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)* 16.9 (2017): 78-81