



# Management of Sodium Hypochlorite Accident: A Case Report

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## Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

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Case Report

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## ABSTRACT

Among root canal disinfection liquids, sodium hypochlorite stands out due to its antimicrobial and tissue dissolving properties. During use, diligent care should prevent extrusion into periapical areas. In spite of precautions when accidents happen, dentists should be familiar with signs, symptoms and treatment strategies. This case report records successful management after accidental extrusion of sodium hypochlorite into the periapical area and explains preventive management protocols for such cases.

**Keywords:** Clinical accidents; dental root-canal; root-canal irrigation; sodium hypochlorite; toxicology.

## 1. INTRODUCTION

In endodontics, disinfecting irrigating solutions are standard adjuncts to biomechanical

preparation of root-canals. Among those available sodium hypochlorite (NaOCl) is the disinfectant of choice due to its antimicrobial and tissue dissolving properties [1]. Sodium

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hypochlorite (NaOCl) dissolves necrotic-purulent tissue and cleans those areas within infected root canals which are otherwise difficult to instrument [2]. However, it does not remove the smear layer [3]. Sodium hypochlorite (NaOCl) also has cytotoxic effects and leads to tissue necrosis [1-4]. These cytotoxic effects are directly proportional to the concentration of sodium hypochlorite used and occur because of its ability to oxidize and hydrolyze cell proteins [5]. Complications which arise when NaOCl extrudes beyond the apical foramen are known as sodium hypochlorite accidents.

Allergic responses and severe tissue reactions are reported in the literature from sodium hypochlorite being accidentally injected into the maxillary sinus [6-8] when mistakenly used as an anesthetic solution [9-10]. The common clinical features observed after sodium hypochlorite accident are severe pain, burning sensation, edema, profuse bleeding from root canal, hematoma and ecchymosis [11]. There may be trismus, anesthesia, paraesthesia, airway obstruction and maxillary sinus involvement depending upon the severity of inflammation and site of tissue involvement [11]. Properties of Sodium hypochlorite not only make it a good endodontic irrigant but also render it a potent cytotoxic agent [1-4]. The pH of sodium hypochlorite is approximately around 11 to 12 and its concentration as an irrigant ranges from 0.5% to 5.25% [5]. Cytotoxic effect of sodium hypochlorite is because of its unique reaction with organic tissues known as saponification [12]. When it comes in contact with vital tissue, it causes hemolysis, ulceration, inhibits neutrophil migration and damages endothelial and fibroblast cells [13-14]. Vascular permeability is also affected by sodium hypochlorite due to either direct damage to blood vessels or by chemical mediators release. As a result, interstitial hemorrhage is generally seen causing spontaneous swelling and bleeding [15]. This article presents a case report of sodium hypochlorite accident, and its successful management.

## 2. CASE REPORT

A 24 year old female patient was referred from a private dental practitioner to Department of Conservative Dentistry and Endodontics, Himachal Dental College, Sundernagar, with massive swelling and excruciating pain on left side of cheek. She gave a history of undergoing root canal treatment from a general dental

practitioner for upper left second premolar 3-4 hours back, and after the treatment on her way home, she noticed progressive swelling and experienced severe pain in her left cheek. After going through the referral sheet it was found that the patient was undergoing root canal treatment with respect to (w.r.t.) upper left second premolar and biomechanical preparation was done at that day under local anesthesia with 5.25% sodium hypochlorite and normal saline used as irrigants. Patient's medical history was noncontributory. During clinical examination, extraorally massive swelling was noticed on the left cheek with ecchymosis in the infraorbital region (Fig. 1). There was no anesthesia or paresthesia in the concerned region indicating no nerve damage. On intra-oral examination, temporary restoration was found w.r.t. upper left second premolar and the tooth was tender to percussion. A swelling was noticed in the buccal vestibule of the tooth. Radiographically, there was no sign of pathosis (Fig. 2). So based upon the clinical examination and the information from the referral sheet it was concluded that the patient had sodium hypochlorite accident.



**Fig. 1. Pre-operative photograph. The left cheek is swollen with swelling distortion reaching below the left eye. The tissue below the eye is erythematous**

Written consent was taken before treatment. Active hemorrhage was noticed from the root canal soon after the removal of temporary restoration. Root system canals were washed with copious irrigation with normal saline until the haemorrhage ended. After the administration of local anesthesia, an incision (1 cm) was given in the buccal vestibule and serous fluid was drained from the buccal space. Immediately after the drainage, there was noticeable reduction in swelling. Wound was closed with 4#0 silk sutures (ACE Surgical Supply Co. Inc.) and no surgical drain was placed. The tooth was sealed with a Cavit (3M ESPE). Post-surgical instructions were explained to the patient including cold

compressions for first 24 hours. She was prescribed a course of antibiotics, analgesic and steroid (Amoxyclav 625 mg TDS for 7 days, ibuprofen 400 mg TDS (thrice daily) for 5 days and Oral prednisolone 30 mg OD (once daily) for 7 days and chlorhexidine mouth rinses twice daily for a week. Patient was examined on 2<sup>nd</sup>, 5<sup>th</sup> (Fig. 3), 7<sup>th</sup> and 9<sup>th</sup> (Fig. 4) day after the accident. On 2<sup>nd</sup> day, there was marked reduction in swelling but ecchymosis was present in the infraorbital region. Tooth was again checked for hemorrhage and irrigated with normal saline. By fifth day the swelling had completely subsided but mild ecchymosis was still there. Non setting calcium hydroxide dressing (Ultracal XS, Ultradent Products Inc. was placed in the canal and patient was recalled on 7<sup>th</sup> day for suture removal. Symptoms were totally resolved on 9<sup>th</sup> day. The pain and swelling subsided on 18<sup>th</sup> day and then the root canal treatment was completed for the concerned tooth (Fig. 5).



Fig. 2. Pre-operative radiograph

### 3. DISCUSSION

In spite of different measures taken by the clinician sodium hypochlorite accidents may happen resulting in catastrophic complications. In most of the sodium hypochlorite (NaOCl) accidents, treatment is palliative and should be started immediately as soon as the first sign appears.

#### 3.1 Causes of Sodium Hypochlorite Accidents

These accidents may occur because of the operators fault in the recommended irrigation technique or there might be additional factors that could contribute to the occurrence of a sodium hypochlorite accident [16]. Loss of

working length, active irrigation, open apex, fractured root, perforation, presence of lateral canals and fenestration may contribute to extrusion of sodium hypochlorite into periradicular area [17]. Chances of sodium hypochlorite accidents are more in buccal and infra-orbital region as the apex of teeth lying in these areas may sometimes fenestrate the overlying alveolar bone naturally. Such accidents are more common in maxilla than mandible because the roots of maxillary teeth are in close proximity to the labial bone surface. Females are more commonly affected than males because of thin and less denser bone. It is more common in upper premolars. The incidence of sodium hypochlorite accident is more in teeth with periradicular lesion because of bone resorption that results in fenestration of the overlying bone [18].



Fig. 3. Follow-up photograph on 5<sup>th</sup> day. The swelling has decreased. The erythema below the eye has reduced considerably



Fig. 4. Follow-up photograph on 9<sup>th</sup> day. No swelling or erythema

#### 3.2 Precautions / Prevention of a Sodium Hypochlorite Accident

High quality radiograph is very important to have an idea of the length and integrity of root canal

system before irrigating [19]. Proximity of vital structures such as inferior alveolar nerve, mental foramen, and maxillary sinus from root apex should be accessed accurately. Rubber dam placement and careful use of sodium hypochlorite are helpful in preventing such accidents. Baumgartner et al. [5] have suggested lowering the concentration but that may affect the potency of sodium hypochlorite. Irrigating device used should be at least 2 mm short of working length during irrigation [18]. Delivery of irrigating solution passively with low pressure not only prevents extrusion of sodium hypochlorite but also prevent apical extrusion of debris from the root canal. Binding of syringe within the canal deliver the irrigating solution actively [19]. Use of luer-luk (side-vented needle) minimizes the risk of accidental extrusion of irrigant into the periapical tissues through the apical foramen [19].



**Fig. 5. Post-operative radiograph with completed root canal treatment**

### **3.3 Management of Sodium Hypochlorite Accident**

The management depends upon the extent of tissue damage and type of tissue involved. More attention is required in maxillary sinus, neuronal, airway obstruction and facial planes involvement [6-10]. During management, sodium hypochlorite solution should be prevented from spreading further into the tissue thus reducing the tissue damage. Try to aspirate sodium hypochlorite via an empty syringe and dry the canal with paper point. Non-setting calcium hydroxide dressing should be given. During first 24 hours, cold compressions may be helpful in controlling the swelling. After 24 hours, hot packs may be helpful in increasing circulation [20]. No study

has described the outcome of using steroids. Analgesic and oral antibiotics should be taken immediately and continued for 5 days. Antibiotics can be modified according to patient's present condition. The patient should be kept under observation for the next few hours to next day and regularly thereafter to monitor the swelling [21]. Root canal treatment(s) can be deferred until the symptoms subside. In cases when patients may have complex medical histories, or who are immuno-compromised, have maxillary sinus, airway and/or facial plane involvement, or if there is a rapid increase in swelling, immediate referral to the local Maxillofacial Department should be considered [22]. Although above mentioned steps are helpful in the treatment of sodium hypochlorite accidents, sometimes there may be incomplete healing with persistence of some of the described accident symptoms.

### **4. CONCLUDING REMARKS**

Sodium hypochlorite is important in root canal treatment as a disinfecting irrigation fluid. Accidents occur with sodium hypochlorite use, but are rare. Consequently, the optimal way to avoid such accidents is to adopt the above mentioned precautions. Should an accident happen, this protocol comprising immediate intervention with patient follow-up will allow reversal of unfavorable reactions and successful resolution of therapy.

### **ETHICAL APPROVAL**

It is not applicable.

### **COMPETING INTERESTS**

Authors have declared that no competing interests exist.

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