

Review Article

Double-Edged Sword (Sodium Hypochlorite Accidents) and insidious intruder(Air Emphysema) in endodontics – A review article

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ABSTRACT:

Endodontic treatment, a cornerstone of modern dentistry aimed at preserving natural dentition, is not without its potential for iatrogenic complications. Among the most alarming of these are sodium hypochlorite (NaOCl) accidents and air emphysema. While relatively rare, their sudden onset and dramatic clinical presentation can be distressing for both the patient and the clinician. This review article synthesizes the current understanding of these two adverse events, focusing on their etiology, clinical features, management strategies, and, crucially, their prevention¹.

Keywords -Double-Edged Sword, Insidious Intruder

Received: 07 July, 2025

Accepted: 03 August, 2025

Published: 09 August, 2025

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This article may be cited as: Sharma Y, Kumari S, Aggarwal B, Singh A. Double-Edged Sword (Sodium Hypochlorite Accidents) and insidious intruder(Air Emphysema) in endodontics – A review article. *J Adv Med Dent Scie Res* 2025; 13(8):7-9.

INTRODUCTION

The goal of endodontic treatment is the complete debridement and disinfection of the root canal system. This is achieved through a combination of mechanical instrumentation and chemical irrigation. Sodium hypochlorite (NaOCl) remains the irrigant of choice for its unparalleled antimicrobial efficacy and tissue-dissolving properties². However, the very properties that make NaOCl effective also render it highly toxic to vital tissues. Concurrently, the use of air-driven instruments and syringes introduces the risk of forcing air into the surrounding tissues³. The sudden and dramatic onset of complications arising from either NaOCl extrusion or air insufflation can be profoundly distressing for both the patient and the clinician, underscoring the need for a thorough understanding of these iatrogenic events.

THE DOUBLE-EDGED SWORD: SODIUM HYPOCHLORITE ACCIDENTS

Sodium hypochlorite is the most widely used irrigant in endodontics, lauded for its potent antimicrobial properties and its ability to dissolve necrotic tissue. However, these same characteristics make it highly cytotoxic when extruded beyond the confines of the root canal into the periapical tissues. A NaOCl accident is an iatrogenic event where the irrigant is inadvertently forced into the surrounding bone and soft tissues⁴.

CAUSES AND CLINICAL MANIFESTATIONS

Several factors can contribute to a NaOCl accident, including:

- **Iatrogenic root perforation:** An artificial opening in the root created by the dentist.
- **Incorrect working length determination:** Leading to instrumentation and irrigation beyond the root apex.

- **Wedging of the irrigation needle:** Creating excessive pressure within the canal.
- **Anatomical variations:** Such as teeth with open apices or large periapical lesions.

The clinical signs and symptoms of a NaOCl accident are typically immediate and dramatic. Patients often report a sudden, sharp pain, followed by rapid and extensive swelling of the adjacent soft tissues. Ecchymosis (bruising) and, in some cases, profuse bleeding from the root canal may also occur. The severity of the reaction is often proportional to the concentration and volume of the extruded NaOCl. In severe cases, tissue necrosis, secondary infection, and even airway compromise can occur⁵.

MANAGEMENT PROTOCOL

Prompt recognition and management are critical to minimizing tissue damage and alleviating patient distress. The immediate management steps include:

1. **Stop the procedure immediately:** And reassure the anxious patient.
2. **Attempt to aspirate the NaOCl:** From the canal using a syringe.
3. **Irrigate the canal with a sterile saline solution:** To dilute and flush out the remaining NaOCl.
4. **Administer local anesthesia:** For immediate pain relief. Long-acting anesthetics can provide prolonged comfort.
5. **Apply cold compresses:** To the affected area to help reduce swelling and pain in the initial 24 hours.
6. **Prescribe analgesics and anti-inflammatory medications:** Such as NSAIDs, to manage pain and inflammation.
7. **Consider antibiotics:** If there is evidence of secondary infection or significant tissue necrosis⁶.

Following the initial management, close follow-up is essential. Warm compresses can be applied after the first 24 hours to improve circulation and promote healing. The patient should be advised to maintain good oral hygiene. In severe cases with extensive tissue necrosis or persistent symptoms, referral to an oral and maxillofacial surgeon may be necessary⁷.

THE INSIDIOUS INTRUDER: AIR EMPHYSEMA IN ENDODONTICS

Subcutaneous emphysema is the dissecting of air into the subcutaneous or fascial planes of the head and neck. In endodontics, this occurs when air is forced into the soft tissues surrounding a tooth.

ETIOLOGY AND CLINICAL PRESENTATION

The most common causes of iatrogenic air emphysema during root canal treatment are:

- **Use of an air/water syringe:** To dry the root canal, especially when the nozzle is placed directly into the canal orifice.
- **Air-driven high-speed handpieces:** Used for access cavity preparation, where air can be forced through an open pulp chamber.

- **Perforation of the root:** Providing a direct pathway for air into the periapical tissues⁸.

The hallmark sign of subcutaneous emphysema is a rapid, usually painless, swelling of the face and neck. A characteristic "crackling" or "crepitus" sound can be felt upon palpation of the swollen area, which is pathognomonic for this condition. The swelling can spread along the fascial planes, potentially leading to periorbital emphysema or, in rare and severe cases, pneumomediastinum (air in the chest cavity), which can be life-threatening⁹.

MANAGEMENT APPROACH

The management of air emphysema is primarily supportive, as the condition is usually self-limiting and resolves as the air is gradually absorbed by the body. The key steps include:

1. **Immediate cessation of the dental procedure.**
2. **Reassurance of the patient:** Who may be alarmed by the sudden swelling.
3. **Thorough clinical examination:** To assess the extent of the emphysema and rule out airway compromise.
4. **Prescription of prophylactic antibiotics:** To prevent secondary infection of the air-filled spaces.
5. **Monitoring the patient:** For any signs of respiratory distress. If the swelling is extensive or rapidly progressing, or if there are signs of airway compromise, immediate referral to a hospital emergency department is mandatory.

Patients should be advised to avoid activities that increase intraoral pressure, such as blowing their nose, sneezing forcefully, or using straws, for a few days following the incident.

THE CONFLUENCE OF COMPLICATIONS: CONCURRENT NaOCl ACCIDENT AND AIR EMPHYSEMA

A particularly challenging scenario arises when a NaOCl accident is complicated by the simultaneous introduction of air, leading to a combined chemical and physical injury. While the exact mechanism can be debated, it is plausible that the forceful irrigation with NaOCl can not only cause chemical burns but also introduce air from the syringe into the periapical tissues. Furthermore, the chemical reaction of NaOCl with organic tissues can produce gases, such as nitrogen and carbon dioxide, which can contribute to the emphysematous state.

The management of a combined incident requires a comprehensive approach that addresses both the chemical and physical insults. The immediate priorities are to manage the pain and swelling from the NaOCl extrusion while closely monitoring for any signs of spreading emphysema and potential airway compromise. The management protocols outlined for each individual complication should be implemented concurrently¹⁰.

PREVENTION: THE BEST MEDICINE

The vast majority of NaOCl accidents and air emphysema incidents are preventable. Adherence to sound endodontic principles and techniques is paramount. Key preventive measures include:

- **Accurate working length determination:** Using an apex locator and radiographs.
- **Use of side-vented or closed-end irrigation needles:** To prevent apical extrusion of the irrigant.
- **Avoiding wedging the needle in the canal:** The needle should be kept loose and moved up and down during irrigation.
- **Gentle and controlled irrigation pressure.**
- **Careful use of air/water syringes:** Never directing a forceful jet of air directly into the root canal. Paper points are the preferred method for drying canals.
- **Use of a rubber dam:** To isolate the tooth and protect the airway.

By integrating these preventive strategies into routine clinical practice, the risk of these distressing iatrogenic complications can be significantly minimized, ensuring safer and more predictable endodontic outcomes.

CONCLUSION

Sodium hypochlorite accidents and air emphysema are serious complications that can arise during endodontic treatment. A thorough understanding of their etiology, combined with meticulous clinical technique and a proactive approach to prevention, is essential for every dental practitioner. In the unfortunate event of such an occurrence, a swift and systematic management strategy can help to minimize patient morbidity and ensure a favorable outcome.

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