



## ORAL MUCOSA DAMAGE BECAUSE OF HYPOCHLORITE ACCIDENT – A CASE REPORT AND LITERATURE REVIEW

Elitsa Deliverska

*Department of Oral and Maxillofacial surgery, Faculty of Dental medicine, Medical University - Sofia, Bulgaria*

### ABSTRACT

**Background** Hypochlorite solution is widely used in dental practice during root canal treatment. Although it is generally regarded as being very safe, potentially severe complications can occur when it comes into contact with soft tissue especially due to its cytotoxic features.

**Objective** The aim of our paper is to present a case of damage of oral mucosa because of leakage of 3% hypochlorite through rubber dam during endodontic treatment.

**Material and methods** We present a 31 years old female with necrosis of buccal mucosa during the endodontic treatment of 46.

**Results** Three days after the procedure the patient was referred to our department for consultation and treatment. Antiseptic lavage was performed and oral antibiotic was administrated. After 5 days intraoral examination showed signs of almost full recovery.

**Conclusion** The need for proper tooth isolation during restorative procedures is obvious. Anything that obscures the operative field negatively impacts operator efficiency and effectiveness. Visibility, patient/operator safety, infection control and the physical properties of dental materials are all compromised when proper isolation is lacking.

**Key words:** sodium hypochlorite, mucosa damage, rubber dam

### INTRODUCTION

Sodium hypochlorite (NaOCl) is the most commonly used solution in root canal treatments, as it is a low-cost method that displays a very effective antimicrobial activity against microbiota of infected root canals [1]. Furthermore, the ability to oxidize and hydrolyze cell proteins and its tissue solvent capacity, increases its value as an irrigant solution [2]. Root canal treatment aims at the complete removal of the connective tissue and the destruction of residual microorganisms found in infected root canals. In addition, it seeks an effective seal in order to prevent recolonization of the root canal system with bacteria. However, this solution can cause complications especially due to its cytotoxic features.[3, 4] The clinical efficacy of NaOCl relates to its nonspecific ability to oxidize, hydrolyze, and osmotically draw fluids out of tissues. Thus, this chemical agent reaches and cleans new areas within infected root ca-

nals, dissolving necrotic-purulent tissues. However, the cytotoxic effects are directly proportional to the concentration of the NaOCl [3, 4]. When this solution is injected into the adjacent tissues, the patient usually experiences intense pain, and an urgent treatment should be implemented in order to prevent a long-term sequelae. [5, 6, 7]

**The purpose** of this paper is to discuss the use of sodium hypochlorite in dental treatment, reviews the current literature regarding hypochlorite complications, and considers the appropriate management for a dental practitioner when faced with a potentially adverse incident with this agent.

Complications causing severe tissue reactions associated with the accidental extrusion of NaOCl into periapical tissues have been described in the literature. Some authors have mentioned clinical situations where sodium hypochlorite was inadvertently injected into the maxillary sinus [6, 7], or was unintentionally injected into the oral mucosa [5] causing adverse tissue reactions and life-threatening allergic responses [8, 9].

With today's heightened awareness of infection control, patient safety, and technique sensitive dental materials, meticulous operative field isolation is mandatory. Barrier isolation (rubber dam) is the most reliable method. If isolation is so important, why do so many clinicians resist using the rubber dam? Perhaps they never really learned to use it effectively. Today the rubber dam is the "Standard of Care" for isolation during restorative procedures and should be employed whenever possible.

### Rubber Dam Benefits

- Dry, clean operating field
- Improved access and visibility
- Improved properties of dental materials
- Patient protection
- Improved infection control
- Increased operating efficiency

Sodium hypochlorite is a commonly used irrigant in endodontic practice. It has many potential complications ranging from permanent bleaching of clothes to severe soft tissue damage. NaOCl is highly irritant when extruded into vital tissues. [10 - 14] The well-perfused tissues of the oral cavity yet have considerable healing ability. The most common complication are described in Table 1.

**Table 1.**

Complication	Author	Study
<b>Extrusion Of Irrigant</b>	Bosch-Aranda ML, Canalda-Sahli C, Figueiredo R, Gay-Escoda C. [15] Motta MV, Chaves-Mendonca MA, Stirton CG, Cardozo HF. [16] Gatot A, Arbelle J, Leiberman A, Yanai-Inbar I. [17]	Response of the human eye to accidental exposure to sodium hypochlorite. Complications in the use of sodium hypochlorite during endodontic treatment. Report of three cases. Chemical eye injuries 1: presentation, clinical features, treatment and prognosis.
<b>Damage to eye</b>	Ingram TA 3rd. [18]  Becking AG. [19]  Khodabukus R, Tallouzi M. [20]	Response of the human eye to accidental exposure to sodium hypochlorite. Complications in the use of sodium hypochlorite during endodontic treatment. Report of three cases. Chemical eye injuries 1: presentation, clinical features, treatment and prognosis
<b>Damage to oral mucosa</b>	Markose G, Cotter CJ, Hislop WS. [21] De Sermeno RF, da Silva LA, Herrera H, Herrera H, Silva RA, Leonardo ML. [22] Linn JL, Messer HH. [23]	Facial atrophy following accidental subcutaneous extrusion of sodium hypochlorite. Tissue damage after sodium hypochlorite extrusion during root canal treatment. Hypochlorite injury to the lip following injection via a labial perforation. Case report
<b>Allergic reactions</b>	Witton R, Brennan PA. [24]  Tosti A, Piraccini BM, Pazzaglia M, Ghedini G, Papadia F. [25] Baumgartner JC, Ibay AC. [26]	Severe tissue damage and neurological deficit following extravasation of sodium hypochlorite solution during routine endodontic treatment. Severe facial edema following root canal treatment. The chemical reactions of irrigants used for root canal debridement.

We describe a case of buccal mucosa necrosis because of leakage of rubber dam during the root canal treatment procedure of 46 and irrigation with 3% sodium hypochlorite. During the rubber dam technique for operative field isolation of the tooth there occurred a leakage of sodium hypochlorite and caused necrosis of the mucosa.

**Fig. 1.** Necrosis of buccal mucosa because of sodium hypochlorite exposure



Three days after the procedure the patient was referred to our department for consultation and treatment. (fig.1) Thirty one years' old female patient complained of

severe pain started some hours after the procedure. Clinical examination showed extraorally swelling and intraoral exam revealed necrosis of mucosa 1/2 cm in vestibular fold of 46, 47 and inflammatory reaction of surrounding tissue.

Treatment consisted of a combination of amoxicillin and clavulanic acid 875/125 mg (Augmentine® 875/125 mg) 1 tablet every 12 hours for 5 days; prednisolone- cortico (60-40-20) taper dose over a 3 day-period using a decreasing dosage; paracetamol (0,500g) 1 tablet every 8 hours; vit C 1,0g twice daily.

**Fig. 2.** Healing process five days after treatment



Five days after treatment clinical examination revealed almost full recovery and epitelization of the lesion. (fig. 2)

Based on the presented case reports, special attention must be drawn to the potential risks associated with the use of NaOCl as an irrigant for root canal therapy. Thus, it is important to carry out an effective technique (isolation of operative field with rubber dam)) in order to avoid complications. In the event of accidental extrusion of NaOCl, treatment guidelines should be applied according to the magnitude of each individual case.

## DISCUSSION

Although a safe root canal irrigating solution, the use of NaOCl may also lead to life-threatening complications [27-33]. So, to ensure best safe, long lasting clinical practice, it is essential to recognize and manage these complications.

Acute inflammation followed by necrosis results when NaOCl comes into contact with vital tissues. It causes severe inflammation and cellular destruction in all tissues.

Sodium hypochlorite when comes in contact with tissue proteins, forms nitrogen, formaldehyde and acetaldehyde in short time and peptide links are broken resulting in dissolution of proteins. During the process, hydrogen in the amino groups is replaced by chlorine thereby forming chloramines which plays an important role in antimicrobial effectiveness. Necrotic tissues are thus dissolved and antimicrobial agent can reach and clean the infected areas better. Pashley et al. [3] demonstrated the cytotoxicity of Sodium hypochlorite using three independent biological models. They found that a concentration as low as 1:1000 (v/v) of Sodium hypochlorite in saline caused complete

haemolysis of red blood cells *in vitro*. As the solution used in this study was isotonic and thus excluded an osmotic pressure gradient, the observed haemolysis and loss of cellular protein was due to the oxidizing effects of Sodium hypochlorite on the cell membrane. Undiluted and 1:10 (v/v) dilutions produced moderate to severe irritation of rabbit eyes whilst intradermal injections of undiluted, 1:2, 1:4 and 1:10 (v/v) dilutions of Sodium hypochlorite caused skin ulcers. Kozol et al. [34] proved Dakin's solution to be detrimental to neutrophil chemotaxis and toxic to fibroblasts and endothelial cells.

Sodium hypochlorite reacts with the proteins and fats of oral mucosa which might lead to secondary infections. The patient must be monitored with immediate treatment if swallowed.

NaOCl is the most widespread irrigant used on root canal debridement. Used solutions may vary from 0.5% to 5.25% and its biocompatibility is inversely proportional to its concentration [1, 2, 4]. When it comes in contact with vital tissues, NaOCl may cause haemolysis, skin ulceration, marked cell injury in endothelial cells and fibroblasts, and inhibition of neutrophil migration [3]. Thus, several studies have been carried out in order to compare the cytotoxic effects with those of other irrigant solutions. Regarding this aspect, Navarro-Escobar et al. [35] compared the cytotoxicity of 15% citric acid, 5% phosphoric acid and 2.5% NaOCl. They concluded that the irrigating solution with the highest percentage of cell viability was 2.5% NaOCl at both 0.1% and 0.5% dilutions. Therefore chlorhexidine gluconate is recommended as an alternative irrigating solution to NaOCl, especially in cases of open apex, suspected allergies to NaOCl or in the event of accidental extrusion [1, 2, 4].

Author	Year	Findings
Veeresh et al. [29]	2011	A patient with continuous , severe pain, oedema on left side of face, managed by antibiotics, analgesics, cold compress and on 10th day all symptoms suppressed.
Loverty PD. [30]	2014	Patient with NaOCl extrusion followed endodontic treatment in maxillary first molar with excruciating pain, with blood stained fluid from left nostril; all managed by first ENT consultant for nasoscopy and then later root canal treatment completed.
Jonathan et al. [31]	2015	A patient with NaOCl extrusion followed perforation during root canal treatment in maxillary first premolar with swelling, bruising; pain was managed by i.v antibiotics, analgesics, steroids and then surgical intervention and finally full recovery was observed.
Bernardo et al. [32]	2014	A patient with NaOCl apical extrusion followed root canal treatment returned in 24 hours with extreme pain, burning sensation in maxillary region with oedema and was managed by amoxicillin 500mg orally for 7 days then dexamethasone 4mg I.M. for 3days. Symptoms subsided after 8 months.

If accident occurs treatment protocol should be followed [36].

Immediate irrigation of canal or damaged soft tissue with normal saline to dilute the sodium hypochlorite.

- Let the bleeding response continue to flush the irritant out.

- Advice ice pack compression for 24 hours (15 minutes interval) to minimize the swelling.

- Recommend warm, moist compress after 24 hours (15 minutes interval).

- Prescribe non steroid anti-inflammatory drugs and pain killers for 7 days. Analgesics and antibiotics must be prescribed to reduce secondary infection. Refer to emergency on inhalation or injection

- Prophylactic antibiotic coverage for 10 days to prevent secondary infection. Amoxicillin 1,0 g (2x1) with/without Metronidazole 500mg(3x1). In penicillin allergic patients prescribed Clindamycin (2x0,600).

- Steroid therapy for 2-3 days to control inflammatory reaction.

- Reassure the patient and provide with both verbal and written homecare instructions.
- Monitor the patient periodically.

## CONCLUSION

Sodium hypochlorite is an effective antibacterial agent but, when in contact with vital tissues it becomes a

potential irritant causing tissue destruction. So, to prevent this, injudicious use should be avoided by the use of a sealed rubber dam isolation during treatment, use of a Leur lock needle for irrigation, maintain a minimum of 2 mm reduction from the working length, avoid wedging of needle into the canal and most importantly avoid excessive pressure during irrigation.

## REFERENCES:

1. Garberoglio R, Becce C. Smear layer removal by root canal irrigants. A comparative scanning electron microscopic study. *Oral Surg Oral Med Oral Pathol.* 1994 Sep;78(3):359-67. [[PubMed](#)]
2. Perez-Heredia M, Ferrer-Luque CM, González-Rodríguez MP. The effectiveness of different acid irrigating solutions in root canal cleaning after hand and rotatory instrumentation. *J Endod.* 2006 Oct;32(10):993-7. [[CrossRef](#)]
3. Pashley EL, Birdsong NL, Bowman K, Pashley DH. Cytotoxic effects of NaOCl on vital tissue. *J Endod.* 1985 Dec;11(12):525-8. [[PubMed](#)]
4. Carson KR, Goodell GG, McClanahan SB. Comparison of the Antimicrobial Activity of Six Irrigants on Primary Endodontic Pathogens. *J Endod.* 2005 Jun;31(6):471-473. [[CrossRef](#)]
5. Motta MV, Chaves-Mendonça MA, Stirton CG, Cardozo HF. Accidental injection with sodium hypochlorite: Report of a case. *Int Endod J.* 2009 Feb;42(2):175-82. [[PubMed](#)]
6. Kavanagh CP, Taylor J. Inadvertent injection of sodium hypochlorite into the maxillary sinus. *Br Dent J.* 1998 Oct;185(7):336-7. [[PubMed](#)]
7. Ehrlich DG, Brian JD Jr, Walker WA. Sodium hypochlorite accident: Inadvertent injection into the maxillary sinus. *J Endod.* 1993 Apr;19(4):180-2. [[CrossRef](#)]
8. Kaufman AY, Keila S. Hypersensitivity to sodium hypochlorite. *J Endod.* 1989 May;15(5):224-6. [[CrossRef](#)]
9. Çaliskan MK, Türküm M, Alper S. Allergy to sodium hypochlorite during root canal therapy: A case report. *Int Endod J.* 1994 May;27(3):163-7. [[PubMed](#)]
10. Gatot A, Arbelle J, Leinberman A, Yani-Inbar I. Effects of sodium hypochlorite on soft tissues after its inadvertent injection beyond the root apex. *J Endod.* 1991 Nov;17(11):573-4. [[PubMed](#)]
11. Navarro-Escobar E, González-Rodríguez MP, Ferrer-Luque CM. Cytotoxic effects of two acid solutions and 2.5% sodium hypochlorite used in endodontic therapy. *Med Oral Patol Oral Cir Bucal.* 2010 Jan;15(1):e90-4. [[PubMed](#)]
12. Hülsmann M, Hahn W. Complications during root canal irrigation: Literature review and case reports. *Int Endod J.* 2000 May;33(3):186-93. [[PubMed](#)]
13. Witton R, Kenthorn M, Ethunandan M, Harmer S, Brennan PA. Neurological complications following extrusion of sodium hypochlorite solution during root canal treatment. *Int Endod J.* 2005 Nov;38(11):843-8. [[PubMed](#)]
14. Kothari P, Hanson N, Cannell H. Bilateral mandibular nerve damage following root canal therapy. *Br Dent J.* 1996 Mar;180(5):189-90. [[PubMed](#)]
15. Bosch-Aranda ML, Canalda-Sahli C, Figueiredo R, Gay-Escoda C. Complications following an accidental sodium hypochlorite extrusion: A report of two cases. *J Clin Exp Dent.* 2012 Jul;4(3):e194-8. [[PubMed](#)]
16. Motta MV, Chaves-Mendonça MA, Stirton CG, Cardozo HF. Accidental injection with sodium hypochlorite: Report of a case. *Int Endod J.* 2009 Feb;42(2):175-182. [[PubMed](#)]
17. Gatot A, Arbelle J, Leiberman A, Yanai-Inbar I. Effects of sodium hypochlorite on soft tissues after its inadvertent injection beyond the root apex. *J Endod.* 1991 Nov;17(11):573-4. [[PubMed](#)]
18. Ingram TA 3rd. Response of the human eye to accidental exposure to sodium hypochlorite. *J Endod.* 1990 May;16(5):235-8. [[PubMed](#)]
19. Becking AG. Complications in the use of sodium hypochlorite during endodontic treatment. Report of three cases. *Oral Surg Oral Med Oral Pathol.* 1991 Mar;71(3):346-348.
20. Khodabukus R, Tallouzi M. Chemical eye injuries 1: presentation, clinical features, treatment and prognosis. *Nurs Times.* 2009 Jun;105(22):28-29. [[PubMed](#)]
21. Markose G, Cotter CJ, Hislop WS. Facial atrophy following accidental subcutaneous extrusion of sodium hypochlorite. *Br Dent J.* 2009 Mar;206(5):263-264. [[PubMed](#)]
22. De SermenPo RF, da Silva LA, Herrera H, Herrera H, Silva RA, Leonardo ML. Tissue damage after sodium hypochlorite extrusion during root canal treatment. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2009 Jul;108(1):e46-49. [[PubMed](#)]
23. Linn JL, Messer HH. Hypochlorite injury to the lip following injection via a labial perforation: Case report. *Aust Dent J.* 1993 Aug;38(4):280-282. [[PubMed](#)]
24. Witton R, Brennan PA. Severe tissue damage and neurological deficit following extravasation of sodium hypochlorite solution during routine endodontic treatment. *Br Dent J.* 2005 Jun;198(12):749-750. [[PubMed](#)]
25. Tosti A, Piraccini BM, Pazzaglia M, Ghedini G, Papadia F. Severe facial edema following root canal treatment. *Arch Dermatol.* 1996 Feb;132(2):231-233. [[PubMed](#)]
26. Baumgartner JC, Ibay AC. The chemical reactions of irrigants used for root canal debridement. *J Endod.* 1987 Feb;13(2):47-51. [[PubMed](#)]
27. Marx JA, Hockberger RS, Walls RM. Rosen's Emergency Medicine: Concepts and Clinical Practice. Mosby Elsevier. 6th edition. 2006; 931-933.
28. Kavanagh CP, Taylor J. Inadvertent injection of sodium hypochlorite

rite into the maxillary sinus. *Br Dent J.* 1998; 185: 336-337.

29. Tegginmani VS, Chawla VL, Kahate MM, Jain VS. Hypochlorite accident – A case report. *Endodontology.* 2011; 23:89–94

30. Lovern PD. A case report of accidental extrusion of sodium hypochlorite into the maxillary sinus during endodontic retreatment and review of current prevention and management. *J Res Dent.* 2014; 2(2):96-100. [[CrossRef](#)]

31. Hatton J, Walsh S, Wilson A. Management of the sodium hypochlorite accident: a rare but significant

complication of root canal treatment. *BMJ Case Rep.* 2015 Mar 25;2015. pii: bcr2014207480. [[PubMed](#)]

32. Almeida AB, Gomes FA, Ferretra CM, de Sousa BC, Costa FWG. Hypochlorite-induced severe cellulitis during endodontic treatment: Case report. *RSBO.* 2014 Apr-Jun;11(2):199-203

33. Al Sebaei MO, Halabi OA, El-Hakim IE. Sodium hypochlorite accident resulting in life-threatening airway obstruction during root canal treatment: a case report. *Clin Cosmet Investig Dent.* 2015 Mar;7:41-44. [[PubMed](#)] [[CrossRef](#)]

34. Kozol RA, Gillies C, Elgebaly SA. Effects of sodium hypochlorite (Dakin's solution) on cells of the wound module. *Arch Surg.* 1988 Apr;123(4):420-423. [[PubMed](#)]

35. Navarro-Escobar E, Baca P, González-Rodríguez MP, Arias-Moliz MT, Ruiz M, Ferrer-Luque CM. Ex vivo microbial leakage after using different final irrigation regimens with chlorhexidine. *J Appl Oral Sci.* 2013 Jan-Feb;21(1):74-9. [[PubMed](#)]

36. Shibu TM. Risks and Management of Sodium Hypochlorite in Endodontics. *Oral Hyg Health.* 2015 Jul;3(3):178. [[CrossRef](#)]

*Please cite this article as:* Deliverska E. Oral mucosa damage because of hypochlorite accident – a Case report and literature review. *J of IMAB.* 2016 Jul-Sep;22(3):1269-1273. DOI: <http://dx.doi.org/10.5272/jimab.2016223.1269>

Received: 18/05/2016; Published online: 12/08/2016



**Corresponding author:**

Associate prof. Elitsa Deliverska, PhD  
Department of Oral and Maxillofacial surgery, Faculty of Dental medicine,  
Medical University Sofia  
1, St. Georgi Sofiiski Str., 1431 Sofia, Bulgaria.  
E-mail: [elitsadeliverska@yahoo.com](mailto:elitsadeliverska@yahoo.com)