

Inadvertent Injection of Sodium Hypochlorite Into Periapical Tissues: Two Case Reports

Sodyum Hipokloritin Periapikal Dokulara Taşırılması: İki Olgu Raporu

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ABSTRACT

Sodium hypochlorite (NaOCl) is the most preferable root canal irrigant in endodontic practice due to its effect on vital or necrotic tissues, lubricant effect during instrumentation and most importantly antimicrobial effect. On the other hand, particular attention must be given to the appropriate and safe use of this chemical solution, because it can be extremely toxic and destructive to cellular tissues when misapplied. Two cases of inadvertent injection of sodium hypochlorite beyond the apex to the periapical tissues of two fractured maxillary incisors are presented.

ÖZET

Sodyum hipoklorit (NaOCl) vital ve nekrotik dokuları çözücü etkisi, enstrümantasyon sırasındaki lubrikasyon etkisi ve en önemlisi antimikrobiyal özelliği sebebiyle endodonti pratiğinde en fazla tercih edilen kök kanal irriganıdır. Buna karşın bu kimyasal solüsyonun hücresel dokulardaki toksik ve yıkıcı etkisi nedeniyle kullanımını güvenli ve uygun hale getirmek özel bir dikkat gerektirir. Sodyum hipokloritin, kırılmış iki santral kesici dişin periapikal dokularına yanlışlıkla enjeksiyonuna ait iki vaka sunulmuştur.

KEYWORDS

Sodium hypochlorite, Complication, Root canal irrigation, Periapical tissue

ANAHTAR KELİMELER

Sodyum hipoklorit, Komplikasyon, Kök kanal irrigasyonu, Periapikal doku

INTRODUCTION

Sodium hypochlorite is a commonly used chemical adjunct to biomechanical debridement of the root canal system. The effective concentration range of NaOCl is from 2.6 to 5.25%^{1,2}. It was used as wound irrigants up to 1915 and has become the most popular irrigation solution in endodontics since Crane described the use of Dakin's solution (0.5% NaOCl), in 1920³. Generally, the solution is applied to the canals during and after mechanical preparation with a disposable plastic syringe with a fine needle attached⁴. Several complications have been described in the literature during root canal irrigation with NaOCl like injection through the apical foramen or allergic reactions to the irrigant³⁻²¹.

Any irrigant, regardless of toxicity, has the potential to cause problems if extruded into periradicular tissues. The inadvertent injection may occur when the apical foramina is wide, the apical construction has been destroyed during canal preparation or through resorption. Additionally, extreme pressure during irrigation or binding of the irrigation needle tip with no release for the irrigant can cause apical extrusion^{8,12,17,18}.

Two cases of inadvertent injection of NaOCl beyond the root apex to the periapical tissues during the root canal treatment are presented below:

CASE 1

A 35 year-old woman applied to Suleyman Demirel University (SDU) Faculty of Dentistry Department of Endodontics with severe pain arising from maxillary left central incisors. The patient's medical history was noncontributory. During clinical examination, an acute apical periodontitis of a coronally fractured tooth was diagnosed. The emergency treatment was decided to eliminate the severe pain. It was determined that a senior student (fifth-year student) administered the local anesthetic and extirpated the necrotic pulp tissue and the patient experienced acute severe pain during irrigation of the root canal

system with 2.5% sodium hypochlorite solution. The root canal preparation was discontinued immediately and canal orifice of fractured tooth was temporarily dressed. Three hours later, the patient came back into the clinic with an extended oedema and ecchymosis over the left side of the face, infraorbital region and upper lip mucosa (Fig 1a). After removing the temporary dress, heavy bleeding from the root canal was observed. The working length, radiograph showed an abnormally short formed root anatomy. Overinstrumentation was occurred during emergency treatment due to lack of initial radiograph (Fig 1b). The correct working length was determined. The root canal was prepared biomechanically using hand instruments with an irrigation of sterile saline solution. Antibiotic (Penicillin, 500mg/3x1) was prescribed against secondary infection and analgesic was also administered for pain control. Cold compress was also advised on the first day. The symptomatology and therapy of the case in following days was summarized in table 1. An allergy test was performed in the dermatology department of SDU-School of Medicine to dispel the suspicion of hypersensitivity to NaOCl. The patch test was applied to the back skin and the left arm of the patient for the 0,1% and 2,5% concentrations of NaOCl. At first and third days, the results revealed no hypersensitivity.

The normal tissue contours were observed and the incisor tooth was asymptomatic twenty days following the NaOCl injection. The root canal was dry when the $\text{Ca}(\text{OH})_2$ dressing was removed, and could be obturated with gutta-percha and root canal sealer using lateral condensation. Two-day after the root canal treatment, post-core restoration was performed for coronal restoration. (Fig. 1 c, d)

CASE 2

A 41 year-old female patient was referred to the endodontic department of SDU-School of Dentistry for treatment of maxillary left central incisor. The patient was suffering from elephantiasis disease. On clinical examination a coronal-

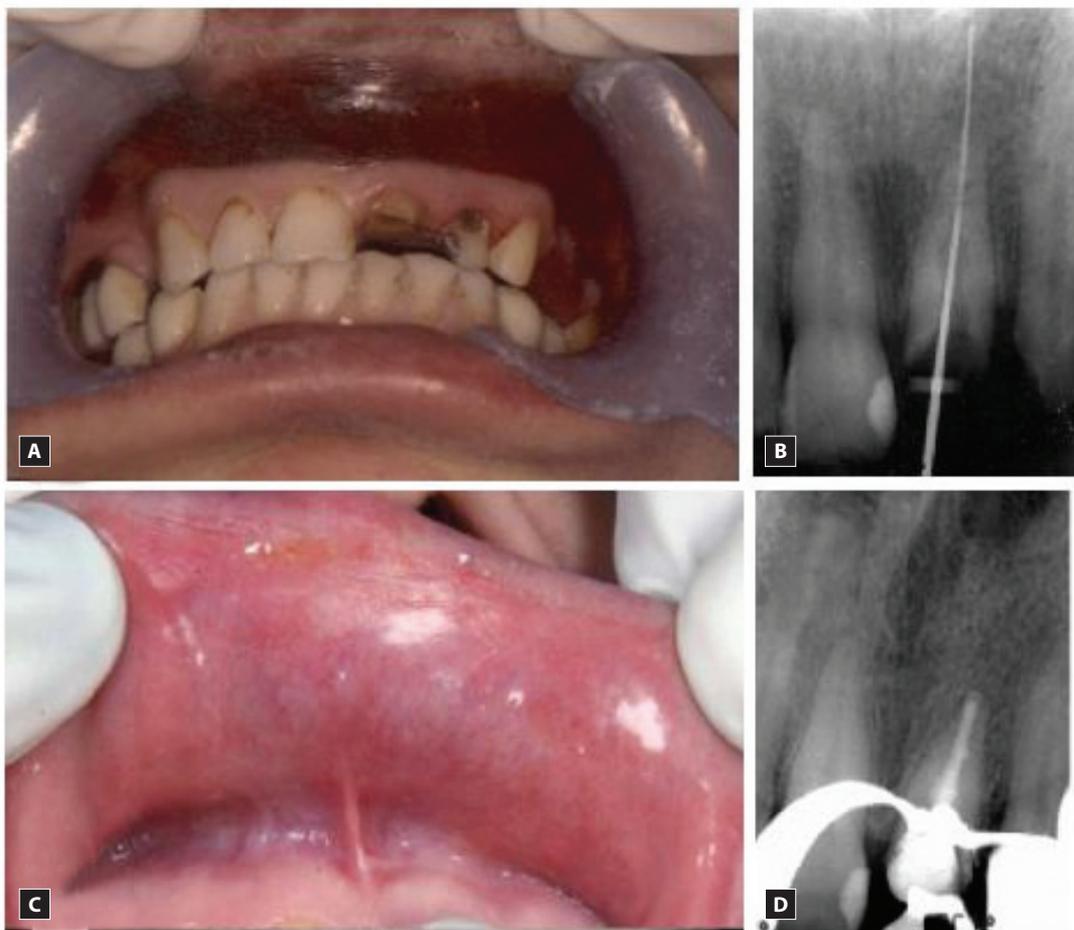


FIGURE 1

1a) Intraoral view showing diffuse swelling and haematoma in the first day. b) Radiograph showing the overinstrumentation c) Intraoral view showing the healing after 20 days d) Final radiograph taken after obturation of the root canal.

ly fractured tooth was diagnosed. Questioning of the patient revealed that she had root canal therapy for her maxillary central incisor two weeks before. The initial radiograph showed no periapical lesion. Root canal treatment of the central incisor was initiated by a senior student (fifth-year student). The working length was determined and the root canal was prepared biomechanically using hand instruments with an irrigation of 2.5 % sodium hypochlorite solution. During the final instrumentation, the patient reacted to pain caused by penetration to the periapical area. However, irrigation of the canal

with sodium hypochlorite was subsequently proceeded. Suddenly heavy bleeding from the root canal occurred followed by diffuse pain. The root canal was immediately irrigated with sterile saline and canal orifice was temporarily dressed. Four hours later, the patient came back into the clinic with an extended oedema over the upper lip and ecchymosis on mucosae (Fig. 2 a, b, c). After removing the temporary dress, seropurulent drainage from the root canal was observed. The definite working length was established 1mm short of the radiographic apex. The root canal was irrigated again with sterile saline solution. To

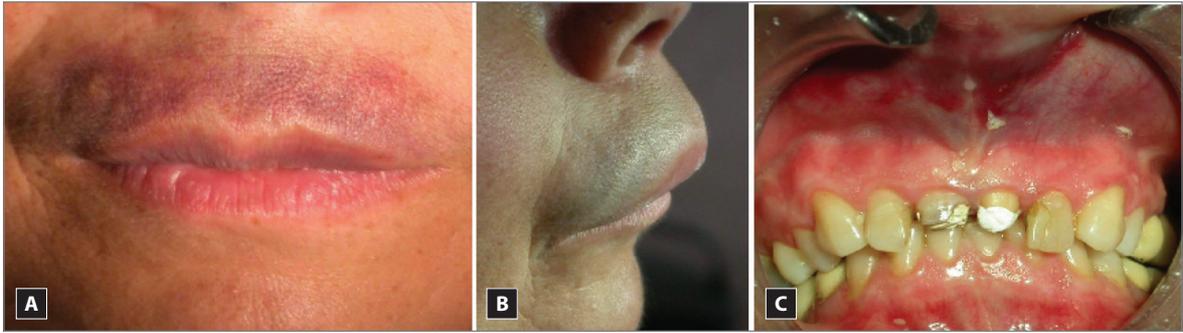


FIGURE 2

2a) Frontal view of the patient showing the oedema on the upper lip in the first day. b) Remarkable extended oedema on the proximal view in the first day. c) Ecchymosis of mucosa in the first day.

avoid superinfection of the soft tissues antibiotic (Penicillin, 500 mg/ 3x1) therapy was initiated and continued ten days. Analgesic was administered for pain control. Cold compress was also advised on the first day. The symptomatology and therapy of the case in the following days was summarized in Table I.

Ten days after the NaOCl injection, tissue contours and colour had returned to normal (Fig. 3 a, b, c) and the incisor tooth was asymptomatic. The root canal was dry when the Ca(OH)_2 dressing was removed, and was obturated with gutta-percha and root canal sealer using lateral condensation.

DISCUSSION

In these case reports, the main reason for appearing symptoms was due to root canal therapy performed without an initial radiograph. It was a serious failure of the clinician. If the senior student had taken an initial radiograph and determined the working length, the severity of the complication could have been less.

The symptoms like ecchymosis, severe pain and profuse hemorrhage in this case were similar to those in other cases, in which the NaOCl was extruded beyond the apex^{3-5,12,13,16,19,21}. It is known that the effects of the irrigant on the patient depend on the type, the concentration and amount of exposure to the used solution²². The

use of a %2,5 concentration of the irrigant must have been helpful for the relatively milder symptoms in the case. The symptoms like paresthesia, difficulty in breathing, NaOCl taste, blurring of vision were not observed as reported in some other cases^{4-6,12,17}.

Some important precautions can be taken to prevent such accidents. First, anatomic properties of the tooth should be examined via radiography. Determining the working length in the first appointment of the root canal therapy will also minimize the iatrogenic failures. Otherwise, gangrenous, anatomically short or immature teeth, the teeth with resorption, strip perforations, apical transportations or root fractures and the teeth with sinus neighborhood will lead to various complications. The biomechanical preparation of the root canal must be discontinued in case of such complications. The patient must immediately be informed about the prognosis. Afterwards, a symptomatological therapy instead of a standardized one is recommended^{4,19,23,24}. For these reasons cold and warm compresses were applied in the presented cases. In addition, because of the infectious root canal and risk of a secondary infection, an antibiotic was prescribed for oral use. A successful therapy was completed without a surgical approach. However, depending on the degree and response of the injury, some cases might require surgical procedure²⁰.

TABLE I

Symptomatology and the therapy of the case

	SYMPTOMATOLOGY		THERAPY	
	Case1	Case 2	Case 1	Case 2
1 st day	Immediate severe pain.	Diffuse pain, heavy bleeding from the root canal		
1 st day after 3-4 hours	Continuing severe pain Extended oedema over the left side of the face, infraorbital region and upper lip mucosa. Heavy bleeding from the root canal.	Extended oedema and ecchymosis over the upper lip, seropurulent drainage from the root canal.	Determination of the correct working length. Biomechanic preparation of the root canal. Irrigation with sterile saline Antibiotics prophylaxis. against secondary infection Analgesics, cold compresses.	Same procedure as Case 1
2 nd day	Ecchymosis of the left infraorbital region and whole upper lip. Increased pain with percussion and spontaneously. Intracanal bleeding and purulent exuda.	Ecchymosis over the upper lip.	Irrigation with sterile saline, Antibiotics prophylaxis. against secondary infection, Analgesics, cold compresses, warm mouthrinses.	Same procedure as Case 1
3 rd day	Decreased ecchymosis. Decreased pain with percussion. Intracanal bleeding and purulent exuda.	Decreased ecchymosis Decreased pain	Irrigation with sterile saline Antibiotics prophylaxis against secondary infection Analgesics, cold compresses, warm mouthrinses	Same procedure as Case 1
7 th day	Decreased ecchymosis Decreased pain with percussion Intaracanal bleeding and purulent exuda		Irrigation with sterile saline Root canal dressing with povidone-iodine Antibiotics prophylaxis against secondary infection Analgesics, cold compresses, warm mouthrinses	
8 th day	Decreased ecchymosis Decreased pain with percussion. No intaracanal bleeding and no purulent exuda Moderate serous exuda		Irrigation with sterile saline Root canal dressing with povidone-iodine	
10 th day	Regressing of all symptoms.	Resolving of all symptoms.	Irrigation with sterile saline. Filling of the root canal with Ca(OH) ₂ .	Definitive root filling with gutta-percha and Sealapex® using cold lateral compaction technique.
15 th day	Resolving of all symptoms.		Refilling of the root canal with Ca(OH) ₂ .	
20 th day			Removing of Ca(OH) ₂ , definitive root filling with gutta-percha and Sealapex® using cold lateral compaction technique.	
22 nd day			Post-core restoration for coronal restoration.	

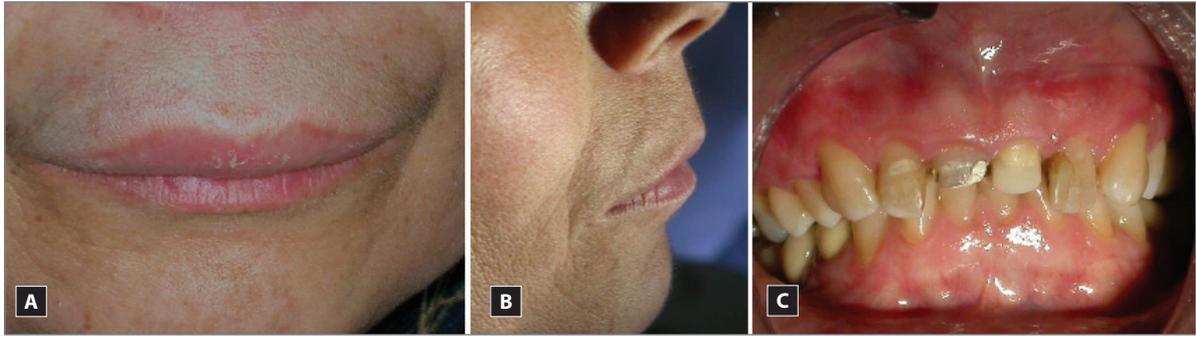


FIGURE 3

3a) Frontal view, showing the healing after 10 days. b) Proximal view, showing the healing after 10 days. c) Intraoral view showing the healing after 10 days.

Rubber-dam use is necessary to prevent the contact of the solution with soft tissues and its aspiration. Patient's or operator's eyes and cloths should be protected effectively against the irrigant. The irrigation needle should not be wedged and a side delivery orifice should be chosen. The irrigation must be done under constant pressure with a passive placement to eliminate a binding in the canal and the access of the irrigant coronally or apically.

Despite these precautions, it was claimed that the contact of the irrigant to the periapical tissues could not be avoided completely²⁵. Cvek et al.^{26,27} showed that the 5 % concentration of sodium hypochlorite solution leads to regression of periapical healing. But a dilute concentration of NaOCl 0.5% is nontoxic to vital tissues and immediately washed away by the circulating blood²⁸.

If any suspicion about substances like household cleansing materials is determined in the history of the patient, a dermatologist can be consulted. Monitoring the patient is critical until the initial phase of the reaction subsides²². The patient must be thoroughly informed about the prognosis of the problem and should be encouraged to come to control visits.

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