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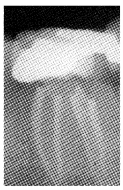

CASE REPORT

Accidental injection with sodium hypochlorite: report of a case

M. V. Motta, M. A. L. Chaves-Mendonca, C. G. Stirton & H. F. Cardozo
Faculdade de Odontologia, Departamento de Odontologia Social, Universidade de São Paulo, São Paulo, Brazil

Abstract

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Aim A case is reported in which sodium hypochlorite (NaOCl) was mistaken for anaesthetic solution and infiltrated into the buccal mucosa during routine root canal treatment.

Summary A 1.5% sodium hypochlorite solution, kept in an anaesthetic cartridge, was inadvertently injected in the buccal mucosa of a 56-year-old female during routine root canal treatment. Soft tissue necrosis, labial ptosis and paraesthesia occurred shortly after the injection. Tissues healed with scarring and lip paraesthesia persisted for 3 years.

Key learning points

- NaOCl is highly irritant when introduced into oral tissues.
- NaOCl solutions should not be kept in anaesthetic cartridges.
- Accidents with NaOCl should be carefully assessed and when appropriate active hospital treatment should be sought.
- Early recognition of NaOCl accidents may avert potentially more serious outcomes.

Keywords: mucosal necrosis, paraesthesia, root canal therapy, sodium hypochlorite.

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Introduction

Sodium hypochlorite solutions have been used in dentistry for almost 100 years (Barrett 1917) and as an important adjunct in root canal treatment for over 60 years (Grossman & Meiman 1941). NaOCl has become the irrigant of choice during root canal treatment because of its antimicrobial efficiency against a broad spectrum of bacteria (Byström & Sundqvist 1983, Cotter *et al.* 1985, Heggers *et al.* 1991, Estrela *et al.* 2003), solvent properties (Estrela *et al.* 2002), relatively low systemic toxicity (The Agency for Toxic Substances and Disease Registry (ATSDR) 2007) and low cost (Clarkson & Moule 1998).

Correspondence: Hilda Ferreira Cardozo, Departamento de Odontologia Social, Universidade de São Paulo, Av. Lineu Prestes, 2227, Cidade Universitária, 05508-000 São Paulo, Brazil (Tel.: 55 11 3091 7891; fax: 55 11 30917874; e-mail: Hilda@usp.br).

Biocompatibility is inversely proportional to the concentration of NaOCl in solution (Hand *et al.* 1978, Estrela *et al.* 2003, Naenni *et al.* 2004) and clinical complications have been described in the literature when inadvertent injection of NaOCl into periapical tissues, the maxillary sinus and oral mucosa have occurred (Table 1) as well as after accidental contact with epithelium surfaces (Serper *et al.* 2004). Hypersensitivity or allergic reactions have rarely been described (Kaufmann & Keila 1989, Çalişkan *et al.* 1994). This report presents a clinical case in which NaOCl was unintentionally injected into the oral mucosa resulting in severe necrosis of the affected tissues and persistent paraesthesia of the upper lip.

Case report

A 56-year-old woman reported severe pain shortly after being injected with what was thought to be anaesthetic solution to complement anaesthesia of the maxillary second premolar tooth. Sudden pain began during injection and it became so excruciating that the endodontic treatment had to be interrupted. A substantial local oedema developed and the patient experienced visual blurring. She was medicated with Arcoxia® (Merck Sharp & Dohme, S.P., Brazil) (90 mg daily for 7 days) and sent home.

Two days later, the oedema had progressed and the injected area was necrotic (Fig. 1). Moreover, the patient reported paraesthesia and ptosis of the right upper lip, severe pain in the right cheek as well as in the right eye and temporal regions and persistent visual impairment. At this point, accidental injection with sodium hypochlorite instead of anaesthetic solution was suspected and antibiotic and anti-inflammatory treatments were initiated with Amoxicillin (GlaxoSmithKline, R.J., Brazil) (500 mg, thrice times per day for 14 days) and Dexa-Citoneurin® (Merck S.A., S.P., Brazil) (dexamethasone associated with B-complex vitamins, 2 mg of dexamethasone once a day for four consecutive days).

Mucosal injury consequent to a chemical burn with salicylate was also hypothesized at the time. However, the patient's claim of never having used the drug topically, the clinical signs of the resulting lesion and the neurological damage observed excluded this possibility. Ophthalmological examination indicated no motor or surface damage to the eyes. The patient's medical history was unremarkable with no previous report of allergic reactions to household products or medication. Visual acuity returned after 8 days, the mucosa healed with scar tissue within 60 days and the lip ptosis resolved within 3 months. Lip paraesthesia has persisted for 3 years.

Discussion

Keeping diluted solutions of NaOCl inside anaesthetic cartridges to facilitate injection into the root canal, although common in certain countries, is a high-risk procedure even for the most experienced clinician. Despite proper labelling, NaOCl and anaesthetic cartridges may be easily mistaken for each other, especially during root canal treatment, when both are required for use.

Based on laboratory studies it has been demonstrated that the deleterious effect of NaOCl is dependent on concentration, pH, osmolarity and nature of the contact (Cotter *et al.* 1985, Pashley *et al.* 1985, Estrela *et al.* 2002, Naenni *et al.* 2004). When injected into periapical tissues or other oral tissues, the initial painful oedema may remain localized or may spread to adjacent tissues (Becker *et al.* 1974, Cymbler & Ardakani 1994, Tosti *et al.* 1996, Mehra *et al.* 2000, Costa *et al.* 2004, Gursoy *et al.* 2006, Pontes *et al.* 2008).

Severe local responses are followed by significant necrosis of the surrounding tissues (Gatot *et al.* 1991, Mehra *et al.* 2000, Witton & Brennan 2005, Gursoy *et al.* 2006, Pontes *et al.* 2008) and extensive oedema and discrete ecchymosis are associated with less robust chemical tissue injuries (Becker *et al.* 1974, Patterson & McLundie 1989, Cymbler

Table 1 Summary of signs and symptoms reported after accidents with NaOCl during root canal treatment

Authors	Case	[NaOCl]	Procedure (tooth)	Oedema	Pain	Visual complications	Ulceration	Vascular complications	Neurological complications	Medication				
										A	Al	Ab	AH	
Becker *et al.* (1974)	23	F	5.25%	I (13)	✔	✔			✔		✔		✔	✔
Herrmann & Heicht (1979)	21	F	5.25%	Block anaesthesia	✔	✔					✔		✔	
Grob (1984)	52	F	3%	I (22)	✔	✔			✔	✔	✔	✔		
Barbas *et al.* (1987)	52	F	–	Mucosa		✔	✔		✔	✔				
Patterson & McLundie (1989)	39	F	1% with H_2O_2	I (14)	✔	✔			✔				✔	
Reeh & Messer (1989)	44	F	1%	I (11)	✔	✔		✔	✔	✔	✔		✔	
Sabala & Powell (1989)	58	M	5.25%	I (13)	✔	✔			✔		✔		✔	
Neaverth & Swindle (1990)	51	F	–	I (22)	✔	✔			✔		✔	✔	✔	✔
Becking (1991)	42	F	–	I (37) (mucosa)	✔	✔		✔		✔	✔		✔	
	31	F	–	I (27) (sinus)	✔	✔					✔			
	29	M	–	After treatment (35)	✔	✔		✔		✔			✔	
Gatot *et al.* (1991)	32	F	5.25% pH 12.9	I (11)	✔	✔	✔	✔	✔	✔		✔	✔	
Joffe (1991)	81	F	5.25%	I (11)	✔	✔			✔	✔			✔	
Ehrich *et al.* (1993)	22	M	5.25%	I (16) (sinus)							✔	✔	✔	
Çalişkan *et al.* (1994)	32	F	1%	I (21)	✔	✔			✔	✔	✔	✔	✔	✔
Linn & Messer (1993)	33	F	–	I (13)Ac I (lip)	✔	✔		✔		✔	✔		✔	
Cymbler & Ardakani (1994)	39	F	2% (1:5 NaCl:H_2O)	I (21)	✔	✔				✔			✔	
Tosti *et al.* (1996)	49	F	–	I (24)	✔	✔			✔		✔	✔		
	46	F	–	I (12)	✔	?			✔		✔	✔		
Kavanaugh & Taylor (1998)	37	M	–	I (15) (sinus)	✔	✔			✔				✔	
Hülsmann & Han (2000)	55	M	3%	I (23)	✔	✔			✔		✔			
	?	M	3% with 5%H_2O_2	I (43) (lip)	✔	✔		✔		✔				
Mehra *et al.* (2000)	51	F	–	I (63)	✔	✔			✔		✔		✔	
Juárez & Lucas (2001)	18	M	–	I (14) (sinus)	✔	✔		✔			?	?	✔	
Balto & Al-Nazhan (2002)	17	F	1%	I (11)	✔	✔			✔		✔		✔	
Costa *et al.* (2004) review of 16 cases			2.5–5%	I	✔	✔		✔	✔					
Gernhardt *et al.* (2004)	49	F	5.25%	I (34)	✔	✔		✔	✔		✔	✔	✔	
Witton & Brennan (2005)	43	F	–	I (12)	✔	✔		✔	✔	✔	✔	✔	✔	

Table 1 *(Continued)*

Authors	Case	[NaOCl]	Procedure (tooth)	Oedema	Pain	Visual complications	Ulceration	Vascular complications	Neurological complications	Medication			
										A	AI	Ab	AH
Witton *et al.* (2005)	44	F	–	I (15)	✔	✔			✔	✔	✔	✔	✔
Bowden *et al.* (2006)	45	M	–	I (37)	✔	✔			✔			✔	✔
Gursoy *et al.* (2006)	21	F	2.5%	AcI (palatal mucosa)	✔	✔		✔	✔				
Keçeci *et al.* (2006)	35	F	2.5%	I (21)	✔	✔			✔		✔		✔
	41	F	2.5%	I (21)	✔	✔			✔		✔		✔
Pontes *et al.* (2008)	35	F	1%	AcI (lingual gingiva)		✔		✔				✔	✔
Pelka & Petschelt (in press)	54	F	3%	I (22)	✔	✔			✔	✔	✔		✔

I, Irrigation; AcI, accidental injection; A, analgesics; AI, anti-inflammatory; Ab, antibiotics; AH. anti-histamine.

Figure 1 Clinical appearance of the injection site.

& Ardakani 1994). It could be hypothesized that solutions that are more alkaline penetrate further into adjacent tissues causing larger zones of coagulation as originally described by Jackson (1953), Seth *et al.* (2007) and Singh *et al.* (2007). Less alkaline solutions, having limited penetration, elicit significant tissue permeability responses but cause minor zones of irreversibly damaged tissues.

In both circumstances, the use of potent anti-inflammatory drugs is recommended immediately after the accident. Antibiotics should be administered if there is any clinical evidence of wound infection or if necrosis is expected (Hales *et al.* 2001, Spencer *et al.* 2005, Mehdipour *et al.* 2007, Singh *et al.* 2007). Neurological damage as described in this case is not common (Witton *et al.* 2005, Pelka & Petschelt in press). However, when present the patient should be referred to dental or medical specialists, who have experience in nerve assessment and repair, for follow-up and possible treatment (Smith & Lung 2006). In addition, the reported visual discomfort consequent to periorbital oedema, which followed the NaOCl injection, resolved shortly after steroid treatment was initiated. Nonetheless, when visual impairment is reported, surface damage to the eye or injury to the oculomotor nerves should be considered.

Fortunately, this kind of complication is rare and the sequence of events following such accidents is well documented. Some of the cases described in the literature required hospitalization and surgical intervention of the affected area. Therefore, it is crucial to examine closely the patient and provide all the necessary care.

Conclusion

The endodontic literature contains several case reports on complications of root canal treatment related to inadvertent use of NaOCl solutions. Accidental injection into periapical tissues because of improper labelling of anaesthetic cartridges containing

NaOCl solutions is preventable and inadmissible. Keeping diluted solutions of NaOCl in anaesthetics cartridges is a high-risk procedure even for the most experienced clinician. Should an accident occur, it is essential to inform the patient about the cause of his or her complaints and to start proper therapeutic and prophylactic measures.

Disclaimer

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