Stomatologija. Baltic Dental and Maxillofacial Journal, 22: 17-21, 2020

Sodium hypochlorite accidents in dentistry. A systematic review of published case reports

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SUMMARY

The aim of this paper was to analyze the literature published in the research related to sodium hypochlorite induced injury. An internet search using search engines- Google, Researchgate and PubMed was carried out. The keywords used for search were- sodium hypochlorite, injury, cellulitis, apical extrusion, ulcer, endodontics. Full text articles of the articles were collected from the year 2007 to 2017. The data available from the clinical trials the journal articles were analyzed and presented in both tabular and descriptive patterns.

Key words: Sodium hypochlorite, complication, cellulitis, apical extrusion, accident, endodontics.

INTRODUCTION

Sodium hypochlorite (NaOCl) is a chemical agent commonly used as a root canal irrigant in endodontic therapy owing to its antimicrobial actions and tissue-dissolving capabilities (1). It is a universally agreed fact that the efficacy of NaOCl is seldom matched as a root canal irrigant (2). The undesirable effect or disadvantage of NaOCl is that it can produce periapical inflammation if extruded outside the confines of root canal (3). Hypochlorite accident" is the common terminology used when NaOCl extrusion endodontics causes acute instantaneous symptoms and possibly serious sequelae (4). The case reports regarding NaOCl accidents have been published in several dental journals but systematic reviews have been relatively few in number (2). With this background the authors conducted a systematic review of systematic published case reports from the past 10 years and critically analyzed the available data on hypochlorite accidents.

MATERIALS AND METHODS

An internet search using search engines (PubMed, PubMed Central, Google scholar, Researchgate) was carried out. The keywords used for search were "sodium hypochlorite", "complication", "cellulitis", "apical extrusion", "accident", "endodontics". Articles ranging from duration of ten years from the year 2007 to 2017 were collected. Only full text articles were included for tabular the analysis. Case reports and case series were considered for analysis. Reviews articles were not included in the analysis. Articles in English language were only considered for the review. PubMed, PubMed Central search identified 164 manuscripts whereas Google scholar and Researchgate search displayed 54 articles. After deleting common articles, non-English articles and articles outside the (2007-2017) range 185 articles were obtained for analysis. After analysis 96 articles had full text and 16 of them were case reports available for analysis (Figure 1, Table).

RESULTS

In total of 14 individual cases reports and 2 case series with 2 cases each (total 18 cases) were evaluated in various parameters. When the gender distribution was taken into account, 16 cases were reported in females and 2 cases were reported in male patients (Figure 2).

When the age of the patients was evaluated, the youngest patient was 4-years old and the oldest was 69 years old. When the mean age of all the patients in the case reports was evaluated it was 45.68 years

When the site of hypochlorite injury was evaluated 13 cases had occurred in the maxilla, 4 cases

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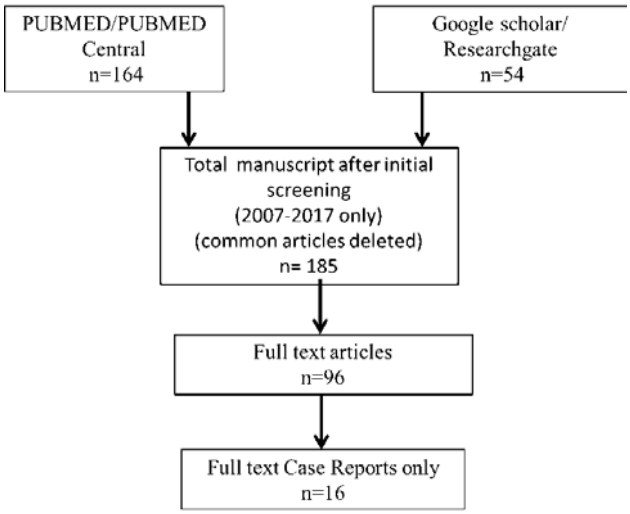

Fig 1. Flowchart of systematic review process

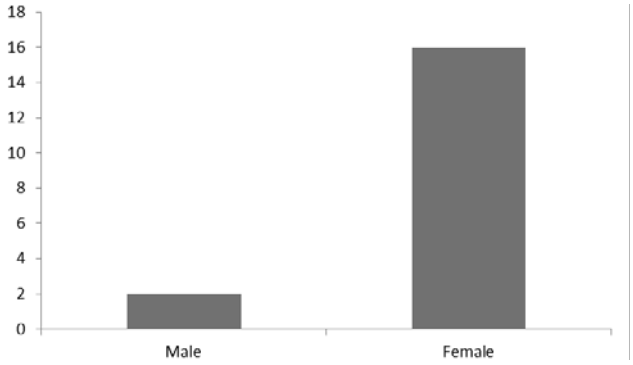

Fig 2. Gender distribution pattern of the hypochlorite accidents

in the mandible and one case report did not mention the site (Figure 3).

In regards of hypochlorite solution concentra-

Table. Details of case reports and case series on hypochlorite accidents during endodontic treatment procedure

Authors / Year	Concentration of hypochlorite used	Age / gender	Tooth involved	Type of injury	Treatment and follow-up
Wang SH *et al.* 2010 (5)	2.5%	Case 1 – 59 / female	23 (axilla)	Accidental periapical extrusion-mid face swelling, bruising	Prescribed analgesics and antibiotics Swelling resolved after 2 weeks
	2.5%	Case 2 – 69 / female	45 and 47 (Mandible)	Accidental periapical extrusion-mid face swelling, bruising	Prescribed analgesics and antibiotics Swelling resolved after 1 week
Teggimani V *et al.* 2011 (6)	3%	31 / female	21 (Maxilla)	Accidental periapical extrusion leading to pain and mid face swelling	Treated with anti biotics and analgesics. Significant reduction in swelling after 10 days.
Bosch-Aranda ML *et al.* 2012 (7)	Not mentioned	Case 1 –- 43/female	22 (Maxilla)	Accidental periapical extrusion-severe swelling in the upper lip	Saline irrigation Intramuscular analgesics and oral antibiotics Swelling resolved after 2 weeks Analgesics, corticoids and intravenous antibiotics were administered
	Not mentioned	Case 2- 53/ female	24 (Maxilla)	Accidental periapical extrusion Swelling that included the area between the periorbital region and the mandibular angle, with hematoma formation in the infraorbital region	After 2 weeks, the patient showed an important decreased of the ecchymosis
Mohan CV *et al.* 2013 (8)	3%	45/female	26 (Maxilla)	Accidental periapical extrusion leading to sudden pain followed by burning sensation and swelling in the periorbital and midface region	Analgesics and antibiotics administered After 7 days, swelling was completely reduced
Saujanya KP *et al.* 2014 (9)	Not mentioned	31/male	Not mentioned	Chemical burn due to contact of sodium hypochlorite Leading to burning sensation and ulcers on lower lip	Irrigated with copious amount of normal saline, and analgesics and antibiotics were given to the patient. Complete healing of the area after 10 days
Al-Sebaei M *et al.* 2014 (10)	3%	42/female	41 (Mandible)	Accidental periapical extrusion Immediate swelling of the lower lip and chin. Rapidly progressed in next 4 hours to involve sublingual spaces causing exhibit signs of upper airway obstruction, with stridor	Treated in intensive care unit (ICU) with oral endotracheal tube. Antibiotic and corticosteroid therapy. Completely healed within 3 weeks
Sajjan GS *et al.* 2014 (11)	3%	33/female	47 (Mandible)	Accidental seepage of hypochlorite into the surrounding gingiva causing sloughing and necrosis on buccal and lingual surfaces	Flap elevation and surgical removal of necrosed bone. Antibiotics and anti inflammatory drugs prescribed

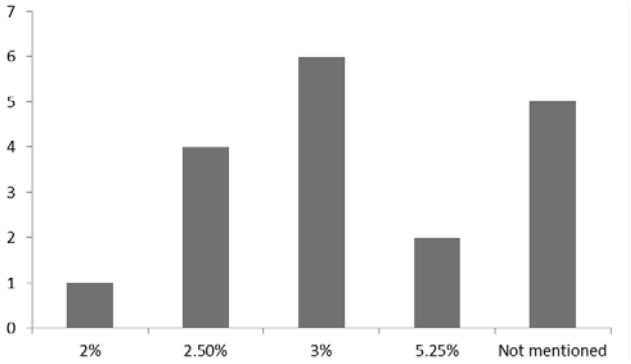

Fig 3. Graphic representation of the concentration of sodium hypochlorite used in case reports

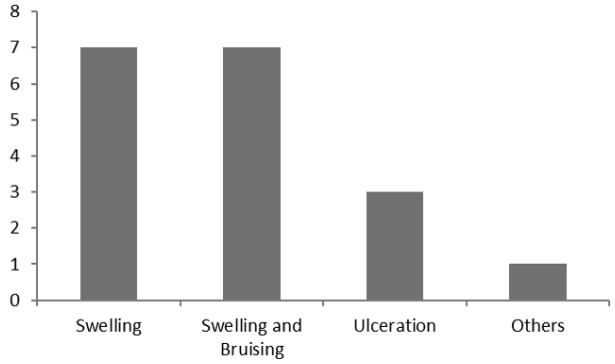

Fig 4. Graphic representation of the clinical features of hypochlorite injury

tion used during the endodontic treatment evaluation, 5.25% NaOCl was used in 2 cases, 3% NaOCl was used in 6 cases, 2.5% was used in 4 cases and 2% was used in 1 case. The concentration of hypochlorite was not mentioned in 5 cases (Figure 4).

When the clinical features of the hypochlorite

Table (continued). Details of case reports and case series on hypochlorite accidents during endodontic treatment procedure

Authors / Year	Concentration of hypochlorite used	Age / gender	Tooth involved	Type of injury	Treatment and follow-up
Aguiar BA 2014 (12)	2.5%	28/female	24 (Maxilla)	Accidental periapical extrusion causing extreme pain and a burning sensation in the left maxillary region. Further leading to edema and cellulitis	Treated with antibiotics and corticosteroids. Complete remission in 3 weeks
Laverty DP 2014 (13)	2%	37/female	26 (Maxilla)	Accidental periapical extrusion causing mild swelling and ecchymosis in the infraorbital region	Treated with antibiotics and corticosteroids Associated pain, swelling and bruising had significantly reduced after 1 week.
Chaugule VB *et al.* 2015 (14)	3%	4/female	64, 65 (Maxilla)	Accidental periapical extrusion causing spontaneous extraoral swelling	Treated with antibiotics analgesics, corticosteroids and antihistaminics. Complete remission after 7 days
Baser Can ED *et al.* 2015 (15)	Not mentioned	56/female	24 (Maxilla)	Accidental periapical extrusion leading to pain, swelling Infraorbital ecchymosis and slight bruising near the nasolabial Fold was also observed	Saline irrigation followed by analgesic and antibiotic therapy Became asymptomatic on the 10th day after the procedure
Hatton J *et al.* 2015 (16)	Not mentioned	66/female	14 (Maxilla)	Accidental periapical extrusion leading to right-sided facial swelling, bruising and pain	Intravenous antibiotics, analgesia and steroids were administered Symptoms reduced 4 weeks following the incident
Rai K *et al.* 2016 (17)	5.25%	24/ female	24 (Maxilla)	Accidental perapical extrusion leading to progressive swelling and severe pain in her left cheek	She was prescribed a course of antibiotics, analgesic and steroid The pain and swelling subsided on 18th day and
Deliverska E 2016 (18)	3%	31/female	46 (Mandible)	leakage of hypochlorite through rubber dam during endodontic treatment leading to necrosis of adjacent buccal mucosa.	Antiseptic lavage was performed. Oral antibiotic was administrated. Recovery within 5 days.
Faras F *et al.* 2016 (19)	2.6%	34/male	17 (Maxilla)	Accidental periapical extrusion leading to pain, swelling and ecchymosis over the right cheek area. Necrosis of hard palate also observed	The patient was treated as a case of chemical burn with creams and ointments. The hard palate necrosis healed completely after 6 weeks.
Campos p *et al.* 2016 (20)	5.25%	45/female	14 (Maxilla)	Accidental periapical extrusion leading to pain, swelling and burning sensation	Saline irrigation followed by analgesic and antibiotic therapy Recovered after 10 days

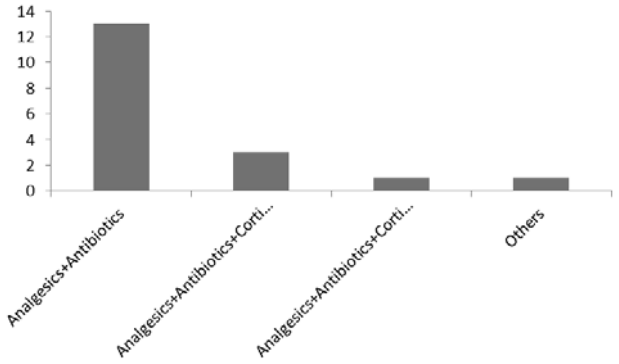

Fig 5. Graphic representation of the treatment modalities used in the treatment of hypochlorite induced injuries

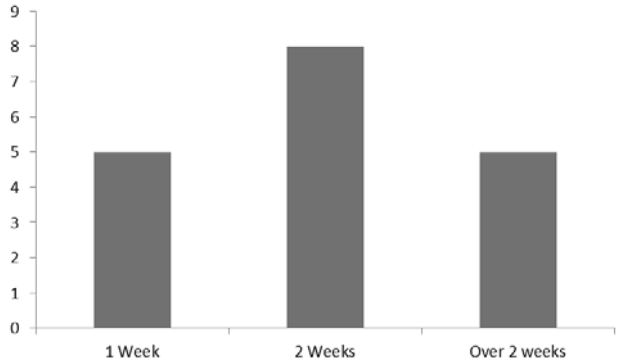

Fig 6. Graphic representation of the clinical features of hypochlorite injury

induced injury was evaluated. Swelling was reported in 7 cases, swelling and bruising in 7 cases and ulceration in 3 cases. Airway obstruction was also reported in one case (Figure 4).

When the treatment administered to the patient was evaluated in the case reports. Analgesics and antibiotics were used in 13 cases; Corticosteroids were administered along with analgesics and antibiotics in 3 cases. Antihistaminics were administered along with a analgesics, antibiotics and corticosteroids in 1 case. In one case the patient was treated with topical ointment (Figure 5).

Time duration evaluation for the signs and symptoms healing ,in all the case reports the lesions healed within 1 week in 5 cases, within 2 weeks in 8 cases and over 2 weeks in 5 cases (Figure 6).

DISCUSSION

The extrusion of sodium hypochlorite beyond the root canal into the peri-radicular tissues causes chemical burn like effect leading to a localized or widespread tissue necrosis called as hypochlorite accident (21).

A recently published systematic review stated the occurrence of NaOCl extrusions was mainly reported in females. Similar observation on gender predilection was found by the authors of the present review. Although there no solid scientific reason for the occurrence of hypochlorite injury in females, some researchers speculate the decreased bone density in females may be cause for this predilection (22). Another probable reasoning for the gender predilection could be that females are generally more concerned about their breath and oral heal and therefore are better motivated to demand for oral health care treatments like endodontic treatment (23). One of the factors determining the hypochlorite injury along with volume of NaOCl and the pressure of extrusion is the concentration of NaOCl (24). In our review majority of the cases occurred due to 3%NaOCl followed by 2.5% and 5.25%. Five of the case reports lacked any information on the concentration of the NaOCl. Similar observation was made in one of the recent reviews wherein NaOCl concentrations were mentioned only in half of the reports included in the review (2-4). Pain and swelling was the most common clinical feature reported in the present review followed by pain and swelling accompanied by bruising and hematoma. Similar observations were noted in a recent review with majority of cases presenting with large and diffuse, extending well outside the site of the affected tooth (2, 7). Airway obstruction was reported in one case in reported in the present review. In a recent review two cases of life-threatening airway obstruction was reported, associated with massive swelling in the sub-mental and sublingual spaces extrusion caused due to NaOCl extrusion through the mandibular molar (25). Analgesics and antibiotics were the most common drugs that were used in the treatment of hypochlorite accident cases. The information obtained from a recent review also revealed that antibiotics and analgesics were the most commonly used drugs (2, 4). Antibiotics were prescribed to prevent increased risk infection resulting as a result of local hematoma and bruising (26). Corticosteroids and anti-histamines were the other drugs that were used in the case reports included in the present review. It has been stated the use of antihistamines limited the extension of edema and also counters histamine associated increase vascular permeability (27). In majority of the cases in the present review, the symptoms reduced within a period of 2 weeks. However in more extensive cases it took more than three weeks for symptoms to subside. Most of the cases reported in literature also have stated that the healing period varying between two to three weeks. However there are cases that have been reported with more complex injuries and healing period ranging from one to two months (28).

CONCLUSION

The occurrence hypochlorite injuries occurring during endodontic treatment is relatively rare but key to successful treatment of this condition on the ability of the clinician to identify the condition early. With this aim the authors have made an attempt to review all the risk factors and classical features of this condition from the most recent full text articles available on the internet search engines.

CONFLICTS OF INTERESTS

None reported.

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Received: 26 08 2018
Accepted for publishing: 21 03 2020