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Letter to the editor

Management of sodium hypochlorite accident in root canal treatment

Sodium hypochlorite (NaOCl) is an inorganic chemical solution produced by the reaction between Na^+ and OCl^-. Since NaOCl has a strong alkaline solution (pH > 11) and tissue-dissolving properties, it is most widely used for disinfecting root canals. Although using NaOCl as an irrigation solution in the root canal system is safe, it can cause serious side effects when NaOCl extrudes from the apical foramen into the periapical tissues. Therefore, using an appropriate treatment plan is essential to reduce NaOCl accidents during root canal treatment.[1] This brief letter focuses on managing NaOCl accidents in dentistry.

It is critical to evaluate the anatomical pattern around the affected teeth with NaOCl accidents to reduce the frequency of these incidents. In this regard, Souza et al. investigated 13 and 5 patients with and without NaOCl accidents, respectively. The study assessed the anatomical relationship between cortical bone and root apex by irrigating the canals with a radiopaque solution and using a CBCT scanner to generate 3D images of the periapical area. According to the results of the study, in 13 patients, the direct contact between the apex and soft tissues was due to bone fenestration. In the control group, where the roots were in cancellous bone or bone-confined periapical lesions, no side effect of NaOCl was observed.[2] Therefore, using a CBCT scan before root canal treatment to evaluate the periapical area can help prevent NaOCl accidents.

In a clinical study, the frequency of NaOCl extrusion was evaluated in 1123 teeth. The results showed that 10 patients (0.9%) had acute pain from the NaOCl accident. Of these 10 patients, 6 and 2 were ascertained with apical bleeding and swelling, respectively. Negative aspiration immediately after acute burning pain and rinsing the root canals with distilled water can reduce the complications of NaOCl extrusion. $Ca(OH)_2$ dressing, anti-inflammatories, and antibiotics should be considered in the case of NaOCl extrusion. Hence, managing NaOCl extrusion should be prepared individually for each patient according to symptoms.[3]

In another study, Karasu et al. evaluated the accidental extrusion of NaOCl in 75 immature maxillary anterior teeth by needle irrigation, ultrasonic irrigation, EDDY, Er:YAG, and diode laser. The samples were divided into 5 groups according to activation irrigation procedures. Regarding irrigant extrusion values, the diode laser and ultrasonic showed satisfactory results in reducing NaOCl extrusion compared to other groups.[4] Applying diode laser irradiation to activated NaOCl is effective in reducing apical extrusion.

Siddique et al. evaluated the efficacy of Garlic-Lemon and NaOCl in 30 patients with apical periodontitis to reduce microorganisms from infected root canals and minimize complications in the case of apical extrusion. The patients were divided into two groups (n = 15), where the root canals in Group A were rinsed with 3% NaOCl and those in Group B with 1.8% Garlic-Lemon solution. Garlic-Lemon showed a high disinfecting ability against microorganisms from infected root canals compared to NaOCl. As a result, instead of NaOCl, it is recommended to use 1.8% Garlic-Lemon as a new rinsing solution, regarding its fewer side effects in the case of extrusion.[5]

A systematic review based on a NaOCl accident summarized 18 case reports and reported as follows: 1) NaOCl concentrations of 2%, 2.5%, 3%, and 5.25% were used for irrigation of canals, 2) swelling, swelling and bruising, ulceration, and airway obstruction were observed in 7, 7, 3, and 1 patients, respectively, 3) time intervals for lesions healing in 5, 8, and 5 patients were within 1 week, within 2 weeks, and over 2 weeks, respectively, and 4) patients were treated with analgesics, antibiotics, corticosteroids, antihistamines, and topical ointment. Thus, to achieve successful treatment, early diagnosis of NaOCl accidents and preventive measures should be considered to protect the patients.[6]

The massive administration of oral bisphosphonates (e.g., alendronate) is associated with osteonecrosis of the jaws. In this respect, a NaOCl accident was reported in a patient under medical treatment with alendronate. This case report study, which was followed up for 8 years, reported that not using an apex locator and misinterpretation of working length in tooth 24 led to over-instrumentation of

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the buccal canal. Acute immediate pain reaction and profuse bleeding were observed when rinsing the canal with 2.5% NaOCl. The following procedures were performed in this case: 1) rinsing the buccal canal with saline solution, 2) drying the canal and placing a temporal filling, 3) IM analgesic (ketorolac 60 mg + dexamethasone 4 mg), and 4) oral analgesic (ketorolac 10 mg for 3 days every 8 hours). After 3 days, ecchymosis and hematoma were observed in the area of the tooth with no evidence of neurologic involvement. After 15 days, the treatment was resumed by adjusting the exact working length, using 1% NaOCl via a side-vented needle in both canals, and the canals were filled. The 8-year follow-up showed no evidence of osteonecrosis of the jaw.[7] Therfore, it is possible to have a successful outcome in patients using bisphosphonate.

Another case report examined the role of low-level laser therapy (LLLT) as adjunctive treatment in a NaOCl accident. The patient (a 39-year-old woman) was referred for treatment of pain and ulceration in the area of tooth 44 with an inadequate access cavity. Examinations revealed a necrotic area in the right mandible with erythematous margins. The NaOCl accident was diagnosed as a chemically induced ulcer. The following treatments were prescribed for this patient: 1) dexamethasone (4 mg every 8 hours for 3 days), 2) amoxicillin (500 mg every 8 hours for 7 days), and 3) applying LLLT every 2 days for 6 visits at a wavelength of 685 nm. The results showed that using LLLT helps recover accidental NaOCl lesions, although more investigation is required.[8]

Regardless of the generations (i.e., 3rd, 4th, 5th, and 6th) of apex locators, they can be useful in determining working length (i.e., apical constriction).[9] The accurate measurement of the canal length and rinsing along it can reduce the extrusion of NaOCl. In addition, using a negative-pressure irrigation system (e.g., EndoVac) can also prevent the risk of apical extrusion.[10] The severity of NaOCl accidents depends on the following considerations: 1) degree of pain, 2) extra- and intraoral examinations (e.g., diffusion of swelling, ecchymosis, hematoma, and trismus), 3) neurological assessment, and 4) airway assessment.[1] Based on the information in this brief letter, the following procedures should be considered to minimize and manage the apical extrusion of NaOCl: A) Minimization: 1) using electronic devices (e.g., CBCT scan and apex locators), 2) irrigation techniques (e.g., irradiation of NaOCl via diode laser, side-vented needle, and EndoVac), and 3) using 1.8% Garlic-Lemon instead of NaOCl in teeth with a high predisposition to apical extrusion. B) Management: 1) negative aspiration immediately after acute pain and rinsing the canal with distilled water, 2) dressing the canal with $Ca(OH)_2$, 3) analgesics, antibiotics, and corticosteroids, and 4) low-level laser therapy. Consequently, the physician's versatility to promptly diagnose a NaOCl accident and an appropriate treatment plan are key factors for successful treatment in this regard.

Declaration of competing interest

The authors have no conflicts of interest relevant to this article.

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Kaveh Nasiri*
Independent Researcher, Essen, Germany

Karl-Thomas Wrbas
Department of Operative Dentistry and Periodontology, Center for Dental Medicine, Oral and Maxillofacial Surgery, Medical Center, University of Freiburg, Freiburg i.Br., Germany, Division of Endodontics, Department of Dentistry, Faculty of Medicine and Dentistry, Danube Private University, Krems, Austria

*Corresponding author. Koenigraetzstrasse, Essen 45138, Germany.
E-mail address: DDS.Nasiri@web.de (K. Nasiri)

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