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Accidental Injection of Chlorhexidine during Endodontic Therapy

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ABSTRACT

The use of chlorhexidine gluconate (CHX) as an irrigating solution in an anesthesia cartridge is a wrong procedure commonly performed in daily clinical practice. Being an invasive procedure, it is invariably associated with complications. A 47-year-old healthy woman was injected accidentally with 2% CHX in the buccal vestibular area instead of an anesthetic solution during a root canal treatment. After the injection, the patient experienced local side effects, such as a burning sensation on the right cheek area, also a discomfort perception at the injection site and a slight inflammation with a mild extraoral redness especially on the right side cheek. The patient was prescribed with antibiotics and anti-inflammatories to reduce pain and inflammation. The patient complained of upper lip numbness by the second day of the accident. The extraoral swelling reduced gradually and the redness diminished considerably over a period of 6 days. At day 60 of follow-up, the patient recovered satisfactorily from extraoral inflammation but still presented a slight numbness of the upper lip. As a conclusion, we can claim that anesthesia cartridges with irrigant solutions should never be used to irrigate the root canals, and accidental injection of CHX should be carefully assessed by the clinician.

Keywords: Accidental Injection; Chlorhexidine; Cytotoxicity

Introduction

Disinfection of the root canal system is one of the goals of endodontic treatment, however, mechanical preparation alone is not sufficient to ensure a bacteria-free canal [1]; in many cases, microorganisms persist after preparation, evidencing the importance of using an irrigant with antimicrobial action [2, 3]. For that reason, an irrigant is used during treatment [1].

Sodium hypochlorite (NaOCl) is the most widely used irrigating solution due to its antimicrobial properties and ability to dissolve organic tissue [4]. However, this irrigating solution has a cytotoxic effect when injected into the periapical tissues, in addition to an unpleasant taste and odor [5]. Chlorhexidine digluconate (CHX) has been suggested as an alternative irrigating solution because it has a broad antimicrobial spectrum, residual action and biocompatibility, and it also has great physical-chemical properties [6]. Due to its inability to dissolve organic tissue, CHX is mainly used as a final irrigant [7], being shown that endodontic treatment in one appointment with a final irrigation of 2% CHX is an acceptable alternative to endodontic treatment of two sessions with intracanal calcium hydroxide medication in upper anterior teeth. To our knowledge, at the moment two studies have been reported in which CHX has been used as the main irrigant during endodontic treatment, the results of the treatments are very similar when (NaOCl) is used [8, 9].

Endodontic mishaps are unfortunate accidents that occur during treatment, some due to lack of care in detail, others being highly unpredictable. Among all the types of accidents mentioned in the literature, a large percentage are setbacks related to irrigation [10]. Extrusion of sodium hypochlorite can occur during instrumentation, in teeth with open apices, through external resorption or root canal perforations [11]. In cases of accidents with NaOCl, the patient may develop acute pain, necrosis, swelling, facial ecchymosis, paresthesia. In most cases, the complete resolution of symptoms was seen within a couple of weeks [12].

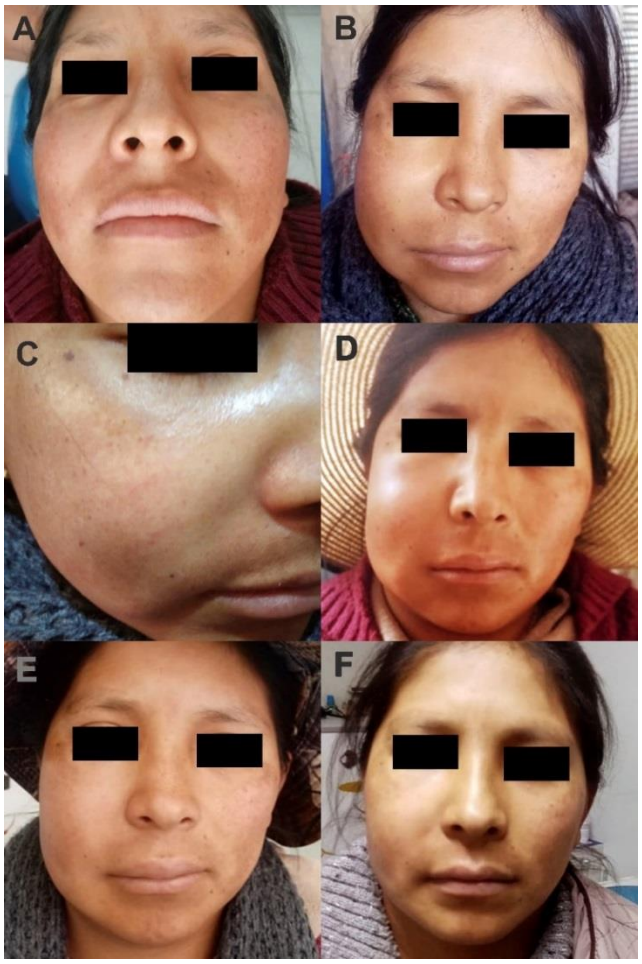

Figure 1. Patient's extraoral signs: *A*) Mild extraoral inflammation immediately after injecting chlorhexidine; *B, C*) Extraoral inflammation and redness in the infraorbital area after 24 h; *D*) Extended extraoral inflammation and redness on the right side of the face after 3 days of observation; *E*) Significant decrease in extraoral inflammation after 5 days; *F*) Almost complete decrease in extraoral inflammation after 6 days

So far, to the best of our knowledge and based on a literature search, two cases about CHX extrusion accidents have been reported during treatment [13, 14]. However, whether the CHX is used as a final or main irrigant, the possibility of accidents will exist and it is important to know how to solve them.

This case report presents a clinical case in which 2% CHX was inadvertently injected into the oral mucosa instead of an anesthetic solution resulting in severe burning and inflammation of the affected tissues and persistent paresthesia of the upper lip.

Case Report

A 47-year-old woman with no contributory medical history presented to the dental office for a fixed prosthetic restoration of the second upper right premolar and also showed considerable sensitivity at the level of the first and second upper right molars. According to the patient's complaint, the second upper right premolar has already been treated endodontically six months ago and was restored with a provisional material; in addition, she has reported having discomfort in the first and second upper right molars when chewing and drinking cold drinks. Considering the dental procedures that must be performed, the informed consent was signed and obtained from.

After clinical and radiographic examination, tooth 14 was diagnosed with irreversible pulpitis, endodontic treatment was started under anesthesia of the posterior superior alveolar nerve. The shift assistant loaded two syringes, one of them with 1.8 mL of 2% CHX (this one had to be used by the other dentist who also works in the clinic) and another syringe to inject the anesthetic solution with 1.8 mL of lidocaine at 2%. Unfortunately, by mistake, the assistant delivered them wrongly. The dentist then administered 2% CHX to the upper posterior-superior area instead of anesthetic solution.

Three min after the injection, the patient began to feel a sharp burning sensation in the area of the right cheek and a feeling of discomfort at the level where the injection was applied; she also presented slight inflammation in the area of the right cheek (Figure 1A). The dental procedure was interrupted and a rapid clinical examination of that area was performed, followed by aspiration of the liquid injected with a 1 mL tuberculin syringe.

Antibiotics were prescribed for seven days (amoxicillin with clavulanic acid 875/125 mg) and diclofenac 50 mg twice a day for 4 days to decrease pain and inflammation. The patient was recommended to report herself to the dental consultation the next day to assess her clinical status. On the next day, the patient presented a slight redness at the anesthesia site intraorally, and extraoral examination revealed great inflammation, with redness that spread to the infraorbital area. She also reported having had fever during the night, painful sensation, burning on the right side of the face and paresthesia of the upper lip (Figure 1B, 1C). She was recommended to return for control the next day.

On the third day, the fever had completely disappeared, but the patient still had extra oral inflammation and numbness of the upper lip. The burning sensation had significantly reduced (Figure 1D). She was recommended to continue taking her medications. Six days after the accident there was a decrease on the extra oral inflammation (Figure 1E, 1F) and cessation of most of the symptoms.

At the 60th day post-accident, the patient was re-examined and the extraoral inflammation of the right cheek had completely disappeared, but still had a slight numbness of the upper lip.

Discussion

Irrigating solutions such as NaOCL and CHX should ideally have a broad antibacterial spectrum, high efficacy against biofilms, ability to dissolve organic tissue, inactivate endotoxins and prevent the formation of smear layer during biomechanical preparation, in addition these should be consistently non-toxic, non-caustic to periodontal tissues and have little potential to cause an anaphylactic reaction [15].

CHX is a broad spectrum antimicrobial, it is an antiseptic widely used for the control of plaque in the oral cavity [16], with aqueous solutions of 0.1 and 0.2% being recommended for this problem, while the concentration at 2% is recommended as an endodontic irrigating solution [17]. In addition to its usefulness as a final irrigant also it is possible to use it like main irrigant, as it has been shown by Zandi *et al.* [8] and Salas *et al.* [9].

CHX would produce less harm than NaOCl [18]. Moreover, CHX was less cytotoxic when compared to EDTA, MTAD (Dentsply Tulsa Dental, Johnson City, TN, USA), QMix (Dentsply Tulsa Dental, Tulsa, OK, USA) and NaOCl [19]. CHX has been shown to be highly cytotoxic in cell culture, there are studies showing cytotoxic effects in human gingival fibroblasts, human periodontal ligament cells, human alveolar bone cells, and human osteoblastic cells [20]. Fibroblasts are important in wound healing, myoblasts and osteoblasts are crucial in skeletal muscle repair and bone healing respectively [21], this serious toxicity depending on the frequency and duration of CHX dose [19, 22, 23].

This case report is important because demonstrates that CHX is an irrigating solution that is used either as a final or main irrigant, in either way, the possibility of accidents exist. In addition, it has been shown that CHX is cytotoxic and not as biocompatible as it seems to be.

In the literature, there is a large number of reports of accidents during the irrigation process. However, the majority of reports correspond to cases of NaOCl injection or extravasation; to the best of our knowledge, there are only two case reports about CHX accidents in the literature [13, 14], the first being an injection report and the second of a CHX extravasation respectively.

According to Guivarc'h *et al.*, [24] management of NaOCl extrusions appeared to be very empirical. Analgesics, antibiotics and steroids were mainly prescribed in the most accidents; however, the use of non-steroidal anti-inflammatory drugs (NSAIDs) has been also reported [24]. In the present case report, because the signs and symptoms of CHX extrusion were very similar to hypochlorite extrusion, it was decided to prescribe the same drugs, which are amoxicillin with clavulanic acid and diclofenac.

Although in many of the reports steroids were prescribed after the NaOCl injury, those weren´t prescribed in this case because there are no clinical studies that have documented their efficacy in these situations [25].

A common feature of both case reports [13, 14] and ours is the loss of sensibility, however, little is known about the possible neurotoxic actions of CHX in the autonomic nervous system. Henschen and Olson [26], studied the possible toxic effects of CHX on the sympathetic adrenergic ground plexus and found that CHX caused a marked and dose-dependent degeneration of adrenergic nerves, besides degeneration of peripheral adrenergic nerve terminals. This could explain the loss of sensibility; however, it is not clear why in the case of Hiremath *et al.* [13], the loss of sensation disappeared and in the case of Khanifam *et al.* [14] and ours, it was present.

A common feature of both case reports and ours is the presence of erythema, which explains the redness of the skin in the first days. The erythema is due to inflammatory or immunological processes, which are normally the result of accumulations of cells of the immune system; in this case, CHX could be acted like strange body. In all cases, the erythema disappeared a few days after the accident.

On the other hand, adverse effects to subcutaneous tissue, nerves and musculature-caused by CHX have not yet been described and published in the literature [14] and this is why an specific protocol cannot still be established for CHX extrusion cases.

It is ideal to have a post-accident CBCT as recommended by Behrents *et al.* [27] and is also advisable to publish the different cases of CHX extrusion so that it is possible to establish a protocol.

Finally, another common feature of our case report with the Hiremath *et al.* [13] case is that both occurred because the irrigating solution was dispensed in anesthetic cartridges, this technique is still being practiced by some dentists in Peru. We strongly recommend leaving this type of irrigation technique, sooner rather than later an accident will happen.

Conclusion

Anesthesia cartridges with irrigating solutions should never be used to irrigate the root canals, accidents with CHX injection should be carefully assessed by the clinician, immediate treatment should be prescribed and the patient must be periodically monitored. In cases with severe complications like inhalation or swallow, the patient should be referred to emergency hospital.

Conflict of Interest: 'None declared'.

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