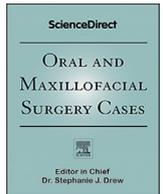




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Local facial atrophy and permanent anesthesia of right upper lip following subcutaneous extrusion of chlorhexidine digluconate



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ABSTRACT

Endodontic therapy is a well-established treatment modality with a high success rate [1]. The aim of endodontic therapy is to prevent or treat periapical inflammatory lesions [2] by removal of connective tissue and microorganisms found in infected root canal [3]. In addition, it seeks an effective seal in order to prevent recolonization of the root canal system with bacteria [4]. Irrigation plays a major role in successful endodontic therapy, and it is used to remove debris from the root canal, eliminate microorganisms, and serve as a lubricant during instrumentation. Therefore, an “ideal” irrigation solution should be efficient as an antimicrobial agent but not toxic to the surrounding tissues [5]. Sodium hypochlorite (NaOCl), ethylenediaminetetraacetic acid (EDTA) and in the recent years chlorhexidine (CHX) gluconate are commonly used root canal irrigants [6]. Negative adverse effects and complications following accidental extrusion of irrigation solutions are well known in the literature for NaOCl [7,8], hydrogen peroxide [9,10] and sulfuric acid [11]. CHX has been advocated to be antimicrobial effective without having the inflammatory disadvantages of NaOCl [12,13]. To our knowledge, there have been no reports of severe tissue damage caused by 2% CHX digluconate during the course of endodontic therapy. Unique to this case report is also the unusual form of harm persistence in the aftermath of injury.

1. Report of a case

A 45-year-old healthy female patient with no history of allergy underwent endodontic therapy on the maxillary right first molar diagnosed with a chronic apical periodontitis. Endodontic treatment, performed by an endodontist, had been commenced using a rubber dam, and the root canal system was irrigated with 2% CHX digluconate as a sole irrigant. During the irrigation, the patient experienced excruciating sudden pain and felt a sensation of severe burning in the right cheek.

Already, after some hours, there was a massive swelling of the right facial side, which spread to mandibular inferior border (Fig. 1). Pain and swelling worsened significantly over the next 24 hours. She was referred to the Department of Maxillofacial Surgery and Hospital Odontology, Oslo University Hospital 2 days after the endodontic treatment. Antibiotic therapy comprising of amoxicillin and metronidazol combination was administered for a period of 30 days. The swelling resolved gradually. Some paresthesia in the cheek's right side continuing to the upper lip also persisted. Three months after the injury, the root canal treatment was completed. Once the swelling had resolved, a progressive shrinkage of the tissue on her right side of the face over the following 2 years was observed. The

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Fig. 1. The photograph was taken by the patient on the evening of the endodontic treatment procedure.

patient was psychologically distressed as a result of her facial appearance, and sought interdisciplinary medical help. On examination 2 years after the incident, there was a localized facial atrophy of the subcutaneous tissue on the right side of the face causing a marked facial asymmetry (Fig. 2). A thinning of the subcutaneous tissue could be palpated in the right buccal mucosa. The patient also had persistent anesthesia of the right upper lip, which was of minor concern and discomfort to her.

The best minimal invasive approach for aesthetic facial recontouring was considered to be autologous fat transplantation from the abdominal region as this has shown to restore volumetric defects with high patient satisfaction [14]. The procedure was performed using local anesthesia lidocaine with epinephrine (2% Xylocaine® Dental with epinephrine 1:50 000, Dentsply Pharmaceutical, PA, USA). Subcutaneous fat was harvested manually by the wet technique [15] using a two-hole Coleman blunt cannula attached to a 10-ml Luer-Lok syringe (Fig. 3). After 30 minutes of gravity separation, the fat was injected by a blunt 17-gauge cannula with a 1-ml syringe into the subcutaneous layer. Severe fibrosis and adherence of the tissue layers were noticed because of previous inflammatory tissue damage. The entire surgical procedure was uncomplicated (Figs. 3 and 4), and the patient reported a high degree of satisfaction at 1-year (Fig. 5A) and 4-year follow-ups (Fig. 5B).

2. Discussion

Ideal endodontic materials, including root canal irrigants, should be systemically nontoxic when in contact with vital tissues, non-caustic to periodontal tissues, and with little potential to cause an anaphylactic reaction [16]. Nevertheless, many of the endodontic materials used today are either chemically neurotoxic or can be mechanically destructive to surrounding structures via compression injury [17]. Various irrigants, like for example NaOCl, EDTA and CHX, are used in the chemo-mechanical preparation of the root canal system. CHX has been used for the past 50 years for caries prevention [18,19], in periodontal therapy [20], and as an oral antiseptic mouthwash [21]. It has a broad-spectrum antibacterial action, sustained action and low toxicity. Because of these properties, it has also been recommended as a potential root canal irrigant [19,22]. The major advantages of CHX over NaOCl are its lower cytotoxicity, lack of foul smell and bad taste.

When used as a root canal irrigant and intracanal medication, it has an antimicrobial efficacy comparable to that of NaOCl, while being effective against certain NaOCl resistant bacterial strains [23]. A possible clinical advantage of CHX over NaOCl is that even



Fig. 2. Clinical situation 2 years after the incident. Note the loss of volume and fat tissue on the right side of the cheek. Patient has permanent anesthesia on the right side of upper lip.



Fig. 3. Subcutaneous fat harvesting by the wet technique. A, Before fat removal, wetting solutions containing saline and epinephrine were infused in the target area. B, Fat harvest using a two-hole Coleman blunt cannula attached to a 10-ml Luer-Lok syringe. C, The harvesting syringe was placed upright until the fat separated.



Fig. 4. Fat transplantation to atrophic right side of face. A, Application of local anesthesia using lidocaine with epinephrine. B, Debridement of scar tissue and application of fat. Results immediately after surgery in the C, frontal and D, profile views.



Fig. 5. Result at A, 1-year and B, 4-year follow-ups. Patient is satisfied with the facial appearance in terms of volume gain on the right side of the face.

though both are effective as antimicrobial agents, CHX is relatively nontoxic [24]. CHX is recommended as an alternative irrigant to NaOCl, especially in cases of open apex, suspected allergies to NaOCl, or in event of accidental extrusion [3,25]. From the present case report, it is obvious that if this agent is exposed beyond the root apex, its properties can be harmful to the surrounding tissues. The main pathways for extrusion of irrigants are the apical foramen and iatrogenic perforation. The diameter of lateral or furcational canals seems to be small enough to exert sufficient resistance to irrigant flow and prevent extrusion of relevant amount of irrigant, although no evidence exists for this assumption [26]. Various studies demonstrate that apical extrusion of debris and irrigant should be expected during endodontic treatment, although the amount of extruded material may vary considerably [26].

The acute problems - sudden pain during root canal rinsing, extensive swelling of the affected facial side, and adverse effects to subcutaneous tissue, nerves and musculature - caused by CHX have not yet been described and published in the literature according to the authors' best knowledge. The rationale for the rapid facial swelling is likely a result of high-pressure CHX irrigation. An over instrumentation has probably occurred which has created a pathway for CHX into surrounding tissues. The agent spread through the buccal fascial spaces causing tissue damage on contact. The resulting inflammatory response correlated with the clinical presentation of rapid swelling and erythema. The subcutaneous tissue inflammation resulted in loss of subcutaneous fat. The resulting inflammatory induced scar formation was noticed during fat injection. Multiple trocar passes were necessary to separate scar tissue and fascial planes to allow proper re-volumization with autologous fat injection.

In this case, a total of 4.5 ml fat was injected in the subcutaneous space, and the volume augmentation was stable after an observation period of 4 years. It is known that the fat survival rate can vary, and in some cases the procedure has to be repeated to obtain an optimal volume correction. In this case, fat was harvested from the abdominal region, but there is no evidence to support the belief that a specific donor site is optimal for a specific recipient site. The fat harvested in this case was purified by simple gravity separation, and there is no consensus that a specific fat purification method is superior to another.

The rationale for the selected treatment was its non-invasiveness and somewhat predictable outcome. Autologous fat represents an ideal facial filler [27]. It is usually readily available, inexpensive, and simple to obtain. There is no risk of host rejection or other immunologic response. Therefore, fat transfer has become a commonly performed plastic surgery procedure. Its excellent suitability, together with the high rates of patient satisfaction, ensures its growing popularity [27].

Endodontic irrigants should have low systemic toxicity and yet allow an optimal disinfection of the root canal system [28]. In laboratory experiments, it has been demonstrated that CHX is highly cytotoxic to human periodontal ligament cells and human fibroblasts via inhibition of protein synthesis [5,29]. Findings from an animal study show that CHX injected in the subplantar space of the hind paw of mice induces severe toxic effects, as evidenced by necrotic changes in the epidermis, dermis and subcutaneous tissue in association with reactive inflammatory response [29]. In addition, CHX added to cultured fibroblasts induced apoptosis at lower concentrations and necrosis at higher concentrations and a markedly increased Hsp70 protein expression, an indicator of cellular stress [29,30]. The clinical relevance of these findings has yet to be proven [26]. Nevertheless, it is important to prevent extrusion of inadvertent CHX.

The U.S. Food and Drug Administration (FDA) announced in February 2017 that while rare, the number of reports of serious allergic reactions to the skin antiseptic CHX products has increased over the past several years. FDA identified forty three worldwide cases reported from January 1, 1969, through June 4, 2015, of anaphylactic reaction with the use of CHX gluconate topical products. Twenty-four of these cases were reported after 2010. All cases were serious: 26 reported the outcome as life-threatening, 12 required hospitalization, and 2 deaths were attributed to the anaphylactic reaction.

The most desirable endodontic antimicrobial medicament would be one that combines maximal antimicrobial efficacy with minimal toxicity [31]. Any irrigant, regardless of toxicity, has the potential to cause problems if extruded into peri-radicular tissues [32]. “Primum non nocere” is an important maxim that should be in focus.

Conflict of interest

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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