

Accidental local infiltration of formalin into the buccal mucosa: A case report and review of the literature

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Abstract

Formalin is a hazardous chemical, yet it is the choice of fixative for diagnostic pathology. Dental surgeons routinely use formalin for preservation of oral biopsy specimens. Literature search revealed that during regular biopsy procedures, unintentional injection with formalin has occurred, and such rare seven cases have been reported till date. In addition to the literature review, the present article describes first case of accidental local infiltration with formalin into the buccal mucosa during a biopsy procedure, its damaging effect on the oral tissues, subsequent judicious management of the patient and successful tissue reconstruction with collagen membrane.

Introduction

Formalin is primarily used as a disinfectant and as a tissue fixative for preserving biologic specimens for histopathological examinations.¹ The tissue fixation properties of formalin are a result of formation of crosslinks between soluble and structural proteins in specimens subjected to it. The resulting structure retains its cellular constituents in their *in vivo* relationships. The primary component of formalin is formaldehyde and for optimum fixation, it is used in the form of 10% neutral buffered formalin.² Exposure to formalin may affect most of the organ systems. Because of the corrosive nature of formaldehyde, its ingestion may show ulcerations and necrosis of the tissues.^{3,4}

The literature search revealed various cases of systemic ingestion of formalin. Among them, only seven cases reported were of accidental injection with the formalin solution. The reported cases involved nerve block injection with formalin solution, such as inferior alveolar nerve, posterior superior nerve, infraorbital nerve, accidental tissue irrigation *etc.*^{1,2,5-10} To the best of our knowledge, the present case is the first of its kind to report accidental local infiltration of oral tissue with formalin and its subsequent management.

Written informed consent was obtained from the patient for her anonymized information to be published in this article.

Case Report

A 40-year old female patient reported with severe pain and burning sensation in her right buccal mucosa. Intra-oral examination revealed a white to blackish elevated lesion on the right buccal mucosa in the second and third molar region measuring about 4x5 cm in size. An extra-oral swelling was also evident, which appeared normal in color but was tender on palpation. During elicitation of detailed history from the patient, it was revealed that patient was tobacco chewer since last 20 years and had leukoplakia patch on the right buccal mucosa. An incisional biopsy was advised for the leukoplakia at a private dental hospital. However, immediately after the local infiltration into the buccal mucosa, the patient complained of severe pain and burning sensation at the site of injection. On investigation of the local anesthetic bottle, it was found that 2 to 3 cc of 10% formalin was injected accidentally, as both solutions were stored in similar containers. Formalin container was placed on the operating table

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for fixation and transport of the biopsy sample. After recording the case history, administration of 2 mL dexamethasone injection, in and around the lesion, was one of the immediate measures taken to reduce inflammation. The extra-oral swelling was noted to increase progressively for the first 24 h, though pain reduced over a period of time. The patient was kept under strict supervision and monitored for any adverse cardiac or pulmonary event for 48 h. Medications prescribed included injection dexamethasone 8 mg twice a day (tapering doses: 8 mg once a day for 2 days and 4 mg once a day for 2 days), injection diclofenac sodium thrice a day to reduce pain, injection taxim 1 gm twice a day for 5 days, injection metronidazole 400 mg thrice a day for 5 days and oral rinses with 2% betadine solution to avoid development of any local infection. Patient was subject to liver and renal function tests and the findings were reported to be within the normal ranges.

After a period of 48 h of observation, the patient was discharged at her request against the medical advice. A follow-up visit was scheduled after 7 days for evaluation of the intra-oral site of injection. In the follow-up visit, necrotic tissue at the site of injection measuring approximately 2x3 cm in size was noted (Figure 1A). Once again the patient was admitted and removal of the necrotic tissue and reconstruction of the defect was planned under general anesthesia. The necrotized tissue, which was of 4 to 5 cm penetration depth, was excised and the

Table 1. Detailed description of the reported cases of accidental injection with formalin.

Sr. No.	Author	Year	Country	Age	Sex	Nerve block	Clinical symptoms	Treatment	Follow-up
1.	Arakeri <i>et al.</i> ⁷	2012	India	35	M	Posterior superior alveolar nerve	<ul style="list-style-type: none"> - Progressively increasing severe burning over the cheek region and around eye - Heaviness in the chest, not associated with dyspnea 	<ul style="list-style-type: none"> - Dexamethasone 8 mg injection - Prophylactic high-dose broad spectrum antibiotic (amoxicillin 1) - Incision with gauge tube drain placed and repeated infusion with saline - Systemic antibiotic course with analgesic - Wound was loosely closed to heal 	1 week
2.	Dandriyal <i>et al.</i> ²	2014	India	35	F	Inferior alveolar nerve	<ul style="list-style-type: none"> - Sharp burning pain - Intense discomfort in the area - After 26 days, swelling and pus discharge on the submandibular region and trismus resulting from active inflammation of the medial pterygoid and subsequent necrosis 	<ul style="list-style-type: none"> - Initial extensive exploration and debridement along the chemical track - Corrugated rubber drain placed and prescribed broad spectrum antibiotics along with analgesics for 7 days - Surgical excision of the necrotic medial pterygoid muscle 	1 year
3.	Bector <i>et al.</i> ³	2014	India	08	M	Inferior alveolar nerve	<ul style="list-style-type: none"> - Severe burning sensation and pain over left mid-face region - Oral dexamethasone 5mg for 5 days - Trismus and peri-orbital edema - After 4 days, an ulcer was noted at the site of injection 	<ul style="list-style-type: none"> - Isotonic saline injection and content aspiration - Affected area regularly irrigated with normal saline and povidone-iodine (1% w/v) solution - Systemic analgesics, antibiotics and vitamin B complex 	4 weeks
4.	Saujanya <i>et al.</i> ¹	2014	India	28	M	Inferior alveolar nerve	<ul style="list-style-type: none"> - Severe pain at right posterior and lingual of mandibular ramus area - Sloughing at pterygomandibular raphae area 	<ul style="list-style-type: none"> - Copious irrigation with normal saline - Analgesics, antibiotics and steroids 	15 days
5.	Vaka <i>et al.</i> ¹⁰	2014	India	28	M	Inferior alveolar nerve	<ul style="list-style-type: none"> - Relentless burning pain - Breathlessness - Extra-oral edema - Necrosis and sloughing of tissues labially and buccally 	<ul style="list-style-type: none"> - Hydrocortisone 100 mg - Administration of amoxicillin (1 g) i.v. - Incision with corrugated rubber drain placed, aspiration and saline irrigation - Wound was closed with 3-0 silk sutures - Systemic antibiotic therapy along with analgesics 	Lost follow-up
6.	Swami <i>et al.</i> ⁶	2016	India	52	M	Metal nerve and lingual infiltration	<ul style="list-style-type: none"> - Severe burning sensation and pain - Palpable tender swelling on the left side of the lower jaw - On the 3rd day a tender, ulcerated lesion was noted at the site of the injection. 	<ul style="list-style-type: none"> - Injection of normal saline (5 mL) to adulterate the injected formalin - Pheniramine maleate (Avil) 45 mg i.v. and dexamethasone 8 mg i.m. - Systemic analgesics, antibiotics, steroids and trypsin/chymotrypsin 	2 months
7.	Gupta <i>et al.</i> ⁹	2016	India	21	F	Infra-orbital nerve	<ul style="list-style-type: none"> - Severe pain and burning sensation at the site of injection and lower eyelid region - Extra-oral swelling and erythema 	<ul style="list-style-type: none"> - Normal saline (10-15 mL) was injected at site to dilute formalin - Dexamethasone 8 mg injection - Systemic analgesics, antibiotics steroids and moxifloxacin eyedrops 	6 months
8.	Present case	2017	India	40	F	Infiltration into the right buccal mucosa	<ul style="list-style-type: none"> - Severe pain - Burning sensation at the site of injection - Site of injection was warm and erythematous - Extra-oral swelling, tender on palpation 	<ul style="list-style-type: none"> - Patient was kept under observation for 48 h with following medications: - 2 mL dexamethasone inj. immediately - Dexamethasone 8 mg i.v. BD/3 days - Diclofenac sodium i.m. TD/day - Taxim 1 gm inj. BD/day for 5 days - Metronidazole 400 mg inj. TD/day for 5 days - 2% betadine mouthwash - After 7 days, necrosed tissue was excised and the defect was reconstructed with collagen membrane 	Follow-up was for 15 days, after which the removal of necrotic tissue was achieved

defect was reconstructed with bovine origin sterile commercially available collagen membrane (Kollagen, Eucare Pharmaceuticals Private Limited, Chennai, India) (Figure 1B and C). Patient was kept on Ryle's tube for feeding to avoid any secondary infection at the site of defect. In the subsequent follow-up visit after 2 weeks, the oral tissues appeared healthy with no post-operative scar formation (Figure 1D).

Discussion and Conclusions

Formalin can enter the body by different routes like ingestion or inhalation. After entering the body it causes fatal metabolic acidosis.⁸ If formalin is exposed to the vascular component of the body, then it leads to acute hemolysis.⁴ In the present case, local infiltration of formalin had occurred accidentally, resulting in acute inflammation at

the site of injection followed by necrosis and ulceration. This accidental injection of formalin befell due to storage of formalin and the local anesthetic solutions in similar containers.^{7,8}

All the cases reported for accidental injection of formalin in the oral cavity are from India. The reason being the frequent use of empty local anesthetic vials for preserving and transferring biopsy specimens

Table 2. Guidelines recommended avoiding accidental injection of chemicals in dental practice.

S. No.	Guidelines
1.	Basic knowledge and training of all staff working in a dental office with respect to handling of dental drugs and chemicals
2.	Local anesthesia containers must never be reused with existing labels
3.	All consumables should have a bottle preferably different from the bottle of local anesthesia and if used must be clearly labelled
4.	Laboratory chemicals must be physically removed from clinical areas
5.	Untrained dental assistants should not be allowed to handle injectable drugs

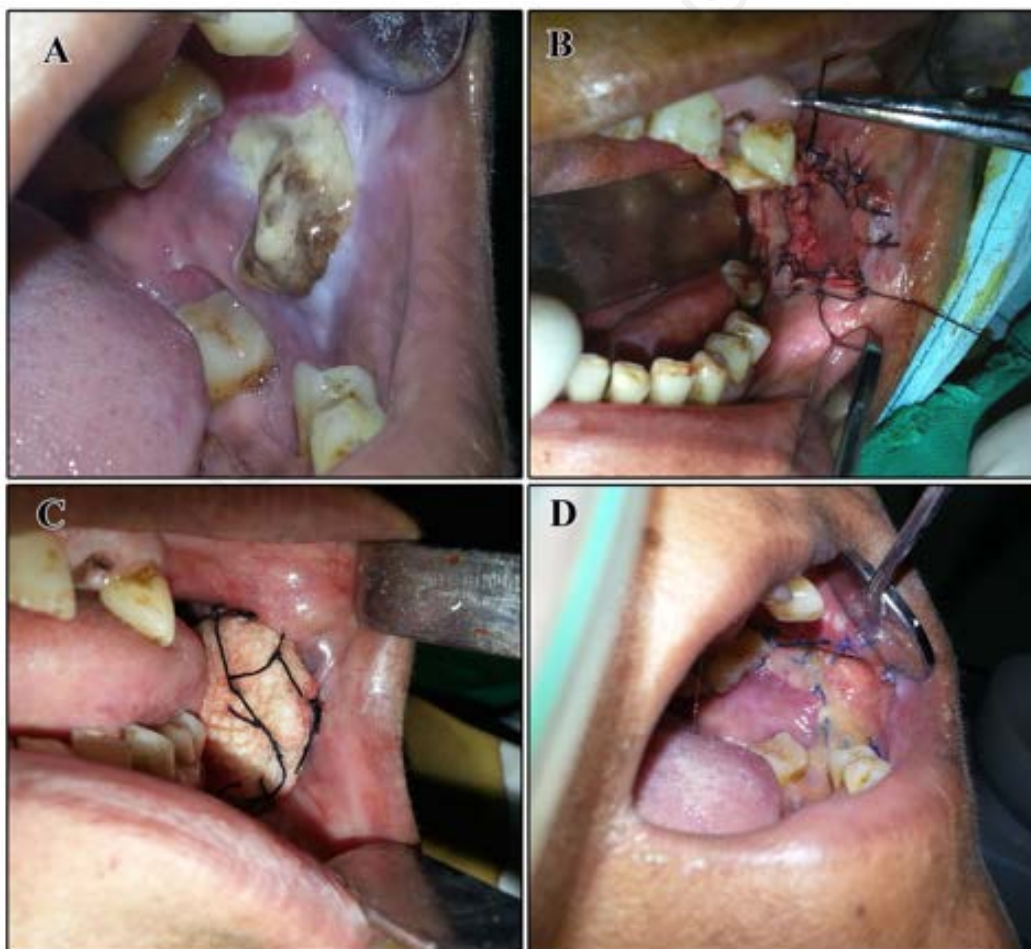


Figure 1. A) Pre-operative clinical photograph after formalin infection showing whitish-brown swelling on posterior part of buccal mucosa; B) intra-operative view showing suturing of collagen membrane on the defect; and C) sterile gauze piece sutured on the collagen membrane for its protection; D) post-operative view showing healing without scar formation.

instead of separately labeled biopsy containers. In dental practice, several colorless chemicals like normal saline, formalin, hydrogen peroxide, and hypochlorite solutions are often simultaneously used; thereby necessitating their proper labeling, separate storage and shelving.²

The literature search revealed that the most common nerve block associated with formalin injection was inferior alveolar nerve block administered during third molar extractions. In addition, single cases of infra-orbital and posterior superior alveolar nerve blocks were also reported. The detailed description of all the seven reported cases are elaborated in Table 1.^{1,2,6-10} The present case describes the first report on accidental local infiltration of formalin.

In many of the reported cases, symptomatic treatment was given to reduce the ill effects of formalin injection. The treatment plan followed was similar to the reported cases in literature, which included initial administration of dexamethasone injection 2 mL at the site of injection to reduce the inflammation, followed by prophylactic treatment with broad spectrum antibiotics, analgesics and steroids. Although, as observed in the reported cases, immediate incision and aspiration of the site would have resulted in a better outcome, in the present case, patient reported with an elevated inflamed lesion and a considerable time had already elapsed. Hence, the patient was started on steroids, analgesics and antibiotics to manage the symptoms. However, the patient aborted the treatment after 48 hrs, following which, after a week, presented with a necrotic area. In the surgical management, debridement of necrotic tissue and the incorporation of collagen membrane for the closure of the wound were conceded. Subsequent follow-up after 2 weeks was planned and post-suture removal healthy oral mucosa with no scar formation was noted.

Biological dressings are rationally superior candidate for the management of wounds. Collagen is a biological substitute, *i.e.* natural, easily available, ready to use,

non-immunogenic, and non-pyrogenic. Collagen can be procured from various resources such as bovine, porcine, equine, or avian origin, which is then purified to make it non-antigenic. Collagen dressings are made of either type I (native) or denatured collagen and they are available in variety of pore sizes and surface areas. Many collagen dressings contain an antimicrobial agent to inhibit the growth of pathogens within the wound.¹¹ To the best of our knowledge, the present case is the first to report successful surgical reconstruction of the defect with the aid of collagen membrane.

To conclude, the recommended guidelines to avoid such type of mishap (Table 2)^{6,7} and the possible explanations for the present unfortunate incident are conscripted.⁷ Firstly, most dental set-ups in developing countries like India do not use cartridges for administration of local anaesthesia. This cartridge-less dental practice creates a vulnerable scenario for inadvertent use of a variety of chemical substances, especially which appear to be colourless solutions. Secondly, unavailability of trained assistants compels most general dental practitioners to seek help of local assistants who are not trained or competent in handling of dental drugs/chemicals. Lastly, a noteworthy point, which includes an unfortunate tradition of reusing local anesthetic containers for storage of dental chemicals in most of the dental set-ups in India, is also needed to be noted. These local anesthetic containers are commonly used to store alcohol, dental acrylic monomer, formalin, and so forth, pose a greater risk of mixing-up of the chemicals.

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