



Glutaraldehyde-Induced Allergic Contact Dermatitis - A Case Report and Safety Standards

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Abstract

A 28-year-old female presented with a severe burning sensation and dark brown patches in the lower chin region, one day following root canal treatment. On the basis of the characteristic appearance of patches and typical burning sensation associated with an allergic reaction, diagnosis of acute contact dermatitis was made. Patch testing by an expert dermatologist confirmed that the patient was allergic to glutaraldehyde. Glutaraldehyde, a popular commercial germicidal product is widely used as cold sterilizing agents for operative dental instruments. The patient developed a reaction as the endodontic files used during the root canal procedure were cold sterilized with 2% Glutaraldehyde. The lesion was healed following administration of corticosteroids and anti-histamines. This report concerns a case of glutaraldehyde induced contact dermatitis. As glutaraldehyde is being used more widely, particularly in dental clinics, this case was of interest and is reported in the safety interest of patients and clinicians.

Keywords: Allergic reaction; Contact Dermatitis; Delayed Hypersensitivity; Glutaraldehyde

Introduction

Glutaraldehyde (GA) is widely used as a sterilizing agent and chemical disinfectant for medical and dental equipment since the early 1960s [1,2]. Glutaraldehyde is a simple, saturated five-carbon dialdehyde with the formula - CHO-CH₂-CH₂-CH₂-CHO [2]. It is being extensively used in the health care profession because of its major advantages of being a potent, rapid and cold sterilizing agent [3]. Moreover, glutaraldehyde does not corrode or damage operative instruments and is relatively cheap [4].

Glutaraldehyde's properties were initially recognized in the health care industry when scientists began to search for an alternative chemical sterilant, which was safer to formaldehyde [1]. Occupational Safety Health Administration (OSHA) regulated the use of formaldehyde by health care workers when it got listed as a potential human carcinogen [5]. Like formaldehyde, the biocidal activity of glutaraldehyde stems from its ability to alkylate sulfhydryl, hydroxyl, carboxyl and amino groups on organic molecules. Following alkylation, RNA, DNA, and proteins, which are the organic molecules present in microorganisms are rapidly denatured leading its bactericidal, fungicidal, virucidal and sporicidal activity [6].

However, since the introduction of glutaraldehyde, as a high-level disinfectant, many research studies have established adverse health effects with prolonged exposure to glutaraldehyde like occupational asthma, breathing difficulties, respiratory irritation, eye itching, rhinitis and skin rashes [3,7]. The first case reported for induced Allergic Contact Dermatitis (ACD) in health care workers was by Sanderson and Cronin in 1968 [8]. However, none of the reports to date have mentioned ACD in dental patients due to the use of instruments disinfected with glutaraldehyde.

This report presents a case of glutaraldehyde-induced ACD in-patient undergoing root canal treatment procedure. The article attempts to cognize and wary, those in profession using glutaraldehyde, to heighten safety standards with glutaraldehyde in the best interest and care of patient and themselves.

Case Presentation

A 28-year-old female patient reported to the Department of Conservative Dentistry and Endodontics in King George's Medical University, Lucknow, with the chief complaint of spontaneous pain in the upper anterior tooth region from the past two days. After clinical and radiological evaluation, a diagnosis of symptomatic irreversible pulpitis was made w.r.t 11 and 13

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Figure 1: Extensive brown patches around the chin area of the patient.



Figure 2: Improvement of the allergic symptoms on the 5th day.

(maxillary right central incisor and maxillary right canine). Root canal treatment was recommended for the offending teeth. An undergraduate final year student undertook the case. Medical history was non-contributory and revealed no episode of allergic response to any drug. Viral markers were investigated with blood test. The patient was non-reactive to HIV & HBsAg. Oral prophylaxis was done before beginning with the treatment. Local anesthesia (2% Lignocaine 1:200000 Epinephrin) was achieved by administering infraorbital nerve block. Isolation of tooth was accomplished with a 5x5 rubber dam. The root canal treatment was initiated in tooth 11 with access opening using endo access bur and Endo-Z tapered safe end bur (Dentsply Maillefer, Switzerland). Negotiation of root canals was done with a size 10 K file followed by working length measurement using #15 K-File (Dentsply Maillefer). Endodontic hand files used for the cleaning and shaping of the tooth had initially been autoclaved. During the operative procedure, glutaraldehyde solution (Korsoster glutaraldehyde USP: 2.45% w/v) was used for rapid chair side disinfection for endodontic files. Apical preparation was completed to size #40 by step back technique. EDTA lubrication (RC-Prep, Dental compare, USA) and constant irrigation of 3% NaOCl and saline at each change of file was done. Calcium hydroxide dressing was given and temporary cement was placed. The patient was recalled the next day for the completion of the root canal procedure.

The patient reported the next day with signs of allergic reaction in and around the chin region with the symptoms of itching and severe burning sensation (Figure 1). Extensive brown patches of various sizes and shapes were seen in the affected area. Allergic reaction to some medicament was suspected. Reviewing the signs and symptoms and how the case was done, a provisional diagnosis of hypersensitivity to either glutaraldehyde or sodium hypochlorite was made. The patient was referred to a dermatologist for investigation to determine if the reported reaction was a reaction to glutaraldehyde itself or other medications administered during the procedure or any other factor. Patch testing revealed a positive response to glutaraldehyde and

negative responses to eugenol, zinc oxide, and sodium hypochlorite.

The patient was comforted and given the following medicines- Tablet Omnacortil 40 mg once daily for two days followed by 20 mg for the next 3 days, Tablet Rantac, 150 mg once daily for 5 days and Tablet Allegra, 180 mg once daily for 5 days. He was advised for local application of Cetaphil moisturizer (Galderma) twice daily until the symptoms subside. The progress of the case was monitored and the rashes on face improved gradually. The patient was recalled for follow up every alternate day. There was a complete improvement in the allergic symptoms on the 5th day (Figure 2). The marks of the reaction also diminished and were almost gone by 2 weeks. No relapse or recurrence was observed during the 3 months follow-up.

Discussion

Two percentage (2%) glutaraldehyde is recommended for the sterilization of endodontic instruments, dental operating areas, and dental impressions [9]. GA popularity for being an adequate sterilizing agent for endodontic files and reamers is attributed to ease of utilization, no adverse effects, and rapid sterilization. Ritchie and Gary Max tested glutaraldehyde as cold sterilizing agent for endodontic instruments by leaving the endodontic files in 2% glutaraldehyde for a period of 14-days. They observed no visible corrosion of the metal portions, softening of the rubber stops and dulling of the cutting edges [4].

Disappointingly, GA has been associated with toxic side effects including allergic contact dermatitis [3,8]. The National Institute of Occupational safety and health has published guidelines for the best practices for the safe use of glutaraldehyde [10].

In this case, the patient suffered from contact dermatitis due to use of instruments sterilized by glutaraldehyde. Most of the documented cases of GA-related allergic contact dermatitis was among health care workers from occupational exposure e.g. disinfection of instruments with GA. Among health care workers, Ravis et al. found a preponderance of these allergic reactions among dental hygienist, dental assistants, and other dental personnels [11].

In the present case, as the clinician wore latex gloves, this barrier prevented his skin in coming in contact with GA. Unfortunately, the patient's chin area came in contact with GA when the dentist touched these areas after holding the endodontic file which was initially cold sterilized with GA. Unlike many types of allergic reactions, which are antibody-mediated, GA induced dermatitis is type IV or delayed hypersensitivity as it takes few to several days to develop [9]. Tammannavar et al. reported a case of immediate allergic contact urticaria to eugenol during dental treatment in which patient developed rashes about one minute after the zinc oxide eugenol placement [12]. Our patient showed a typical presentation of allergic contact dermatitis, which often manifests as a rash, which begins several hours after contact and like irritant dermatitis, is usually confined to the area of contact as in this case.

A study tested the permeability of gloves to 2% GA solutions. Latex gloves exhibited breakthrough at 45 min while nitrile rubber, butyl rubber, synthetic surgical glove, and polyethylene were each impermeable for at least 4 h [13]. According to the protocol, Personal Protective Equipment (PPE) including gloves and eye protection should be worn while handling GA. Following disinfection, the instruments should be rinsed thoroughly with sterile water. Each rinse should be a minimum of 1 minute in duration, and a large volume of fresh water must be used for each rinse [5,10]. This was done to

ensure that there is no residual GA on the instrument. In this case, the reaction seems likely to have occurred due to the residual GA on the instrument, coming in contact with gloved finger of the clinician and eventually, contacting the patient's chin, when the dentist rested his fingers on that area. In a study by Nethercott et al. ten employees who were followed for six months after initial diagnosis of ACD- from glutaraldehyde continued to have persistent hand eczema [14].

As glutaraldehyde is being extensively used in all dental clinics and hospitals, it would be reasonable to report this case. Strangely, in spite of the established guidelines, it has been seen, that cases of GA induced contact dermatitis have been on a continuous rise, especially among health care workers. This might be attributed to lacunae in the implementation of the guidelines or the ineffectiveness of the laid guidelines or lack of awareness of these guidelines.

Health care employers and employees need to understand and control exposure to GA. Moreover, alternative methods for cold sterilization of endodontic files and other instruments should be preferred for e.g., using a chairside glass bead sterilizer. In case of using GA, personal protective monitoring, training, exposure monitoring, disposal practices and spill and clean-up procedure should be well understood and applied.

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