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MANAGEMENT OF 35 % HYDROGEN PEROXIDE EXPOSURE TO NAKED EYES: A CASE REPORT AND REVIEW

SREERAM S R*[1], PRABHATH SINGH [1], PREETHEE THOMAS[1], K N UNNI[1] AND S THARANI[2]

1. Amrita School of Dentistry; Amrita Institute of Medical Sciences and Research Centre; Kochi India.
2. Bharathi Womens College Chennai India.

ABSTRACT

Exposure of strong acids to eyes is a rare uneventful situation. This case reports one such case where accidental exposure of dental bleaching agent which contain 35 percent of hydrogen peroxide to patients naked eyes in a dental office which was successfully managed without any corneal damage
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KEYWORDS: **35 % Hydrogen peroxide accident, Tissue effect, Eyes,Balanced Saline Solution.**

SREERAM S R
Amrita School of Dentistry; Amrita Institute of Medical Sciences and Research Centre; Kochi India.

***Corresponding author**

INTRODUCTION

Accidental exposure of chemical is a very uneventful scenario which has come across in majority of chemists. Dentistry is one such field where the operator uses many strong chemicals for various dental treatments. One such to name is Hydrogen Peroxide. 35 Percent of this chemical is used for the bleaching of stained teeth.This is a case report of accidental Exposure of 35 % of hydrogen peroxide to the patient's eye.

CASE REPORT

A 35 year old female patient reported to the dental OP with a chief complaint of discoloured tooth. It was planned to bleach her discoloured tooth.Prior to procedure, the patient was advised to wear an eye protective wear, and the consequences of the chemical agent were informed. Even then she refused to wear the eye protective wear. During manipulation of the bleaching agent which contain35 % of hydrogen peroxide,there was an accidental exposure of the bleaching agent to her left eye. Patient had an immediate burning sensation and was unable to open her eyes. Soon the patient was convinced to open her eye and the eye was simultaneously flushed with copious balanced saline solution. Gradually the situation was made under control and the irrigation of her eye was continued with balanced saline solution. The patient was made comfortable slowly with just irrigating her eye with balanced saline solution .After 15 min of continuous irrigation the patient was able to keep her eyes open but she complained of irritation during closure of eye lid and during movement of eye ball . Clinically the redness of the eyes still persisted. The patient was made to lay on supine position and with assistance her eye lid was opened inside out and noticed a layer of ruptured and dead epithelium .This tissue was carefully removed by swabbing out with a sterile swab and an antibiotic eye drop was applied for avoiding further infection. The patient was then comfortable and was able to make all the movements without difficulties.The patient was then taken to the Ophthalmology OP for the final check up.No abnormalities were detected on ophthalmic examination. She was advised cold application for an hour.

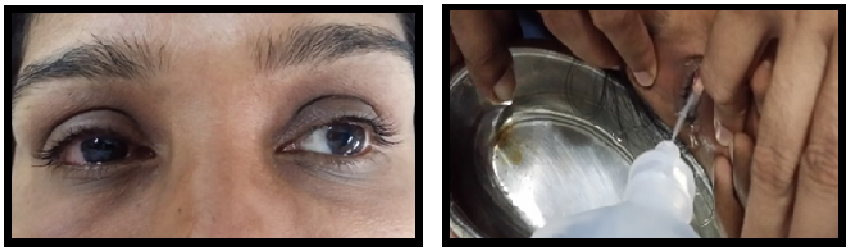

Figure 1
Immediately after the acid exposure on the left eye and flushing it with copious Balanced Saline Solution

Figure 2
Dead tissue on the eyes lids and removal of the dead tissue using a cotton swab.

Figure 3
After 24 hours of exposure

DISCUSSION

Direct exposure of skin or eyes to 30 per cent hydrogen peroxide may cause severe irritation or burns, while ingestion may be irritating to the oesophagus and stomach, causing bleeding and sudden distension [1] [2]. The hazard rating for contact with 3 per cent hydrogen peroxide is rated as slight, while for 30 per cent hydrogen peroxide the hazard is rated as extreme because of the corrosive nature of strong hydrogen peroxide solutions[3].

The chemical reactions of hydrogen peroxide

Hydrogen peroxide is a member of a family of related molecules termed reactive oxygen species. This family includes a number of radicals (that is, species which contain one or more unpaired electrons), such as the superoxide (O_2.-), hydroxyl (HO.), peroxyl (ROO.) and alkoxyl (RO.) radicals. Hydrogen peroxide is formed by the reaction of superoxide (O_2.-) with itself, that is, a dismutation in which one molecule O_2.- is oxidized by the other. Within cells, hydrogen peroxide and the superoxide and hydroxyl radicals can be formed enzymatically and non-enzymatically[4]. Hydrogen peroxide can damage cells via several mechanisms and delay cell division. In the presence of chloride ions, the action of peroxidase on hydrogen peroxide produces hypochlorous acid (HOCl), which acts at low molar concentrations (10-20µmol/l) to damage proteins on cell membranes and destroy their function[5]. In addition, hydrogen peroxide can diffuse through lipid membranes and once inside the cell is able to react with iron, copper and other metallic ions to generate the highlyreactive hydroxyl radical (HO.) and other oxidants[6]. These substances initiate chain reactions of lipid peroxidation which cause decomposition of the phospholipids of cellular membranes, which results in damage to lysosomal membranes and leakage of their destructive contents. The hydroxyl radical also damages the inner mitochondrial membrane, which can lead to the loss of viability of the cell. Superoxide can contribute to this process by reducing a cellular source of ferric to ferrous iron, and it is the latter which reacts with hydrogen peroxide to produce the more potent oxidizing agents[4]. In cell culture systems, in which protective enzyme systems (catalase and superoxide dismutase)are diminished or absent, hydrogen peroxide can exert marked cytotoxic effects. With a 30 minute exposure to a bolus dose of hydrogen peroxide in phosphate buffered saline at 37°C, cells can survive an exposure to 250µmol/l hydrogen peroxide, whereas at 350 and 500µmol/l exposure is lethal to a small fraction of cells. The oxidative stress causes decomposition of membranes with time and dose dependent leakage of damaging lysosomal hydrolytic enzymes. There is also cellular damage in the form of surface blebbing and increased autophagocytosis which become more marked with heigher doses hydrogen peroxide. Of note, all these alterations are reversible, provided the cells are exposed to non-lethal doses [7]. However in this case immediately after exposure of 35 percent hydrogen peroxide the exposed area was flushed with copious amount of balanced saline solution (BSS; Herr et al. 1991)[8].Balanced saline solution has an enhanced buffering capacity; it prevents the cornea from swelling and preserves the corneal endothelium

(McNamara et al. 1987)[9]. This will neutralize the acidic pH created by the acid and flushes out the foreign bodies if any without affecting the epithelium. Even after 15 min of irrigation the patient still had the discomfort during closure of eyes, was because there was dead tissue formedon her eye lids due the high concentration of the acid, which had to be removed with a cotton swab which lead her to comfort followed by application of an antibiotic drop inorder to avoid further infection . A thorough ophthalmic examination was done one the patient was comfortable by an ophthalmologist to make sure if there was any damage to the cornea and no abnormalities was found after examination. Patient was advised cold application in order to reduce the inflammatory response and reviewed after 24 hours. The patient was totally asymptomatic and there were no signs of redness, oedema or discomfort to the patient.

CONCLUSION

Hydrogen peroxide compromises several cellular functions, the end result of which can be cell death. While hydrogen peroxide may be injurious to tissue directly, secondarily derived oxidants such as hydroxyl radical as well as hypochlorous acid can also contribute to tissue injury. As we all heard the words “Prevention is better than cure” hence outmost care should be given while handling such chemicals and necessary protective measures had to followed for the protection of eyes and in case of such case of accidental exposure of 35 % hydrogen peroxide to it the best remedy is to flush with copious balanced saline solution as a first aid.

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