



Tooth Bleaching Agents in Dentistry

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ABSTRACT:

Being recognised by International Agencies of Regulation, Hydrogen and Carbamide Peroxide are the most successful dental bleaching techniques used in Dentistry.

On correct evaluation of the case proceeding for bleaching, the operator, Dentist in this case, should have appropriate knowledge of using the peroxides in quantity and necessity.

Over a period of years, operators have been exposed to many different techniques, products and brands of peroxides with light curing or activation being most commonly used.

In this literature review, we will provide evidence based research on peroxides for satisfactory final results for clinical use.

Keywords : tooth whitening, hydrogen peroxide, carbamide peroxide , vital tooth

Introduction :

Various problems related to tooth may result in staining or discolouration of tooth. Discoloration can be both extrinsic or intrinsic. Extrinsic colour may be due to use of tobacco, consuming chromatogenic food or drinks etc. Intrinsic staining may be due to enamel microcracks, excessive fluoride ingestion, tetracycline medication, dental caries etc. Various types of dental bleaching procedures are used with high concentration of peroxides to whiten the tooth. We will be discussing about all in the following article. Study involving techniques of dental bleaching involves direct use of hydrogen and/or carbamide peroxide.⁽¹⁾

Various bleaching agents :

HYDROGEN PEROXIDE (H₂O₂):

Studies have shown that exposure to low levels of hydrogen peroxide present in dentrifices on a daily basis produces less exposure than bleaching agents containing high levels of hydrogen peroxide. A hamster cheek pouch model also showed that 3% or less H₂O₂ had no carcinogenic or adverse effect even with prolonged use. In a study where patients have used hydrogen peroxide for a long period of time it has been seen that gingivitis indices and plaque has decreased. Presently it is also used clinically to eliminate contamination of spore forming agents. It may also be used to irrigate during BMP at a conc. of 3%.⁽¹⁾⁽³⁰⁾

CARBAMIDE PEROXIDE (CH₆N₂O₃):

Carbamide peroxide (also known as urea hydrogen peroxide) is used for loosening ear wax, teeth whitening and to clean oral wounds. It is a white colour solid which is crystalline in state and is soluble in water. Sensitivity in dentin and irritation in gingiva are some of the contraindication of carbamide peroxide. A small clinical study has confirmed that use of 10% carbamide peroxide produces predictable tooth whitening. 30% hydrogen peroxide with 10% carbamide peroxide combines to make an excellent in-office bleaching agent when used under observation and following safety protocols by the operator. 3% carbamide peroxide containing whitening toothpaste is being widely used nowadays but their effectiveness is unevaluated.⁽²⁾⁽³⁾⁽³¹⁾⁽³²⁾

ENZYMES :

Stained tooth can be treated by enzymes due to the fact that extrinsic tooth pigmentation is due to chromogens which are usually derived from polyphenols. Use of enzymes can be beneficial compared to conventional methods as it can effectively accelerate the reactions. **Proteolytic enzymes** were the first

enzyme to be used in dental bleaching. As most teeth stains are due to tannins, **Tannase** is useful for removing such stains. Some other enzymes used are oxidoreductase, catalase, laccase and peroxidase.(26)(27)(28)

Table 1. Concentrations and use of hydrogen and carbamide peroxides(29)

Peroxides	Concentrations	Use
<i>Hydrogen Peroxide</i>	10%	At home
	35%	In office
	40%	In office
<i>Carbamide peroxide</i>	10%,15%,16%,20%,22%	At home

Tooth bleaching procedures:

Tooth whitening which is a very complex procedure has been seen to depend on factors that has been stated below:

- Bleaching agent pH
- the fluctuation of irradiation
- tooth size
- Length of photo activation
- Application technique
- Layer of bleaching agent placed on enamel and its thickness (4)(5)

These tooth whitening treatments help in changing the aesthetic looks of patients hence giving them immense self confidence and psychological support.

- **At home**
- **By a professional at office or clinic**

At home technique, considered as a more cost-effective technique needs an intraoral device such as a tray and the value of the dental colour obtained is sustained for a longer period of time. Effectiveness of OTC products for tooth bleaching may be controversial. OTC bleaching agents contains hydrogen peroxide,dyes,anticalculus,anti staining agent and abrasive agents. Whitening rinses are also available in which lower concentrations of hydrogen peroxide is present.

At the clinic, photo activation method is performed by a professional and various sessions may be required depending on the desired shade and the shade obtained may be longer lasting.(6)(7)(8)

Bleaching can be done on both vital and non vital tooth: **Non-vital tooth bleaching** : Intra-coronal bleaching is a bleaching method in which there is whitening of non vital discoloured tooth. This method requires proper obturation of the non vital tooth to prevent the bleaching compound to touch with periapical tissues. **Walking bleach** technique may be used. Combination of sodium perborate and water or hydrogen peroxide is used.

It is placed inside the chamber of pulp and the pulp chamber is sealed and left for 7 days. Procedure may be repeated until desired shade is obtained. (9)(10)(11)

Vital tooth bleaching : Dentist may perform vital tooth bleaching at the clinic or people may themselves perform it at the ease of the home. High concentrations of hydrogen peroxide such as 35 to 50% may be used by dentist and is often proceeded by heat source. Bleaching compound is loaded in the patient's mouth for 30 mins to 2 hours in a tray. "Night guard" or "at home" bleaching can be administered by the patient in a custom made tray by applying 5 to 22% of carbamide peroxide. OTC products may be availed in the form of prefabricated trays and strips which can be adjusted by the user. (12)(13)

Light sources:

Heat and light sources are actively used to enhance the action of peroxides .CO2 argon and diode lasers are the most commonly used lasers for photo activation .LED laser produces blue light with high energy photos which activates the molecule of hydrogen peroxide-and hence is most favoured. LED lamps activate hydrogen peroxide more effectively and safely and is inexpensive. LED lamps do not produce temperature increase of the pulp more than 5.5 degrees. Halogen light activation enhances whitening of tooth. (14)(15)(16)

Mechanism of action of peroxides :

The oxidizing agent , i.e , hydrogen peroxide is highly reactive in aqueous state and readily produces free radicals (perhydroxyl) which aids in the bleaching effect of tooth surface.(19) 3% to 20% concentration of carbamide peroxide comprise of carbamide peroxide containing carbopol base. Carbopol has been seen to decrease release time of hydrogen peroxide without changing effectiveness of treatment. (20) Success of any dental bleaching procedure requires peroxides to penetrate enamel and dentin. (21)

Effects of bleaching process :

Powerful in office bleaching can produce soft tissue burns. Tissue burns are reversible if tissue is exposed for short period of time and with less quantity. Soft tissue burning can be prevented by rubber dam application. Some investigations have stated that tooth bleaching can lead to increased porosity and increased depth of enamel grooves. Also, it has been found in many studies that though bleaching can cause changes in micromorphology of tooth, but there is no changes in enamel hardness. Some studies found that bleaching does not change hardness of enamel but it affected the hardness of root dentin. Presence of residual peroxide on tooth surface may interfere with resin bonding and prevent complete polymerization. One aftereffect of tooth bleaching is sensitivity of tooth. Application of potassium nitrate may aid in the treatment of the after effect. Sodium fluoride and fluoride varnish may also aid in the same .(22)(23)(24)(25)

Conclusion

The demand for tooth bleaching has been increasing day by day as people are getting increasingly aware about the importance of aesthetics. Thus many fabricators and scientists are driven to develop various bleaching agent/product that can be used anywhere. For tooth whitening two major approaches has been evaluated as both chemical bleaching as well as mechanical cleaning by toothpaste abrasives. Mechanical cleaning depends on abrasive that are suitable for the tooth type. Chemical bleaching leads impressive result after multiple sessions in dental office by use of high concentration of peroxides.(17)(18)

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