

Basics in Tooth Bleaching

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ABSTRACT

Personal appearance is important in today's society. Many products and procedures, including tooth whitening, are being marketed to the public as a method for enhancing personal appearance. Present tooth-bleaching techniques are based upon hydrogen peroxide as the active agent. Scaling and polishing of the teeth remove many extrinsic stains. There are a number of methods and approaches that have been described in the literature for the bleaching of vital teeth. There are many reasons given by patients for whitening their teeth like youthful appearance, getting married, improving self-esteem. This article will give an overview of bleaching.

KEYWORDS: Bleaching, Hydrogen Peroxide, Stains, Tooth Whitening

INTRODUCTION

Now a days patient pay a great importance to aesthetics of the teeth, specially tooth colour.¹ Dentists are called upon to respond to requests from patients who wish to enhance their smiles. The effect of a smile can be so significant that advertising experts refer to this phenomenon as "smile power."²

Tooth discoloration varies in etiology, location, severity, appearance and affinity to tooth structure. It can be classified as extrinsic, intrinsic or combination of both, according to its location and etiology.³

Intrinsic discoloration is caused by incorporation of chromogenic material into dentin and enamel either during odontogenesis or after eruption. Exposure to high levels of fluoride, inherited developmental disorders, tetracycline administration, and trauma to the developing tooth causes pre-eruptive discoloration. After eruption of the pulp necrosis, tooth aging and iatrogenesis are the leading causes of intrinsic discoloration.

Coffee, tea, carrots, oranges, and tobacco give rise to extrinsic stain. Wear of the tooth structure, deposition of secondary dentin due to aging or as a consequence of pulp inflammation, and dentin sclerosis can hamper the light-transmitting properties of teeth, leading to teeth darkening.⁴ The methods available to manage discolored teeth range from:

- Whitening toothpastes
- Removal of surface stain by prophylaxis
- Tooth whitening techniques or bleaching
- Abrasives and acid for micro abrasion of enamel
- Operative techniques to camouflage the underlying discoloration, such as veneers and crowns.^{1,5}

Bleaching procedures are effective and certainly less

destructive than any full or partial prosthetic restoration.⁶

Tooth bleaching can be performed externally, termed vital tooth bleaching or intracoronally in root-filled tooth, called non-vital tooth bleaching. The bleaching of non-vital teeth is relatively low risk treatment for improving the esthetics of endodontically treated teeth.⁷

HISTORY

Tooth bleaching is not a new technique in dentistry. In 1916, Adams reported the use of hypochloric acid to treat fluorosis. In 1937, Ames reported a technique using a mixture of hydrogen peroxide and ethyl ether on cotton, heated with a metallic instrument for about 30 minutes, and applied in 5 to 25 visits to treat mottled enamel. In 1966, the combined use of hydrochloric acid and hydrogen peroxide was promoted to remove brown stain from mottled teeth. In 1970, Cohen and Parkins published a method for whitening tetracycline-discolored dentin of the teeth of young adults treated for cystic fibrosis. This was the first publication indicating that there is chemical penetration of hydrogen peroxide to the dentin to whiten teeth. Previous study concentrated entirely on the removal of extrinsic staining only.⁸

Reports on bleaching discolored non-vital teeth were first described during the middle of the 19th century, advocating different chemical agents. Initially, chlorinated lime was recommended, followed later by oxalic acid and agents such as chlorine compounds and solutions, sodium peroxide, sodium hypochlorite, or mixtures consisting of 25% hydrogen peroxide in 75% ether (pyrozone). An early description (1884) of the use of hydrogen peroxide was reported by Harlan. Superoxol (30% hydrogen peroxide) had been mentioned by Abbot in 1918. In 1924 Prinz recommended using heated

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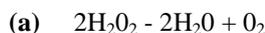
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solutions consisting of sodium perborate and Superoxol for cleaning the pulp cavity. Some authors proposed using light, heat, or electric currents to accelerate the bleaching reaction by activating the bleaching agent.³

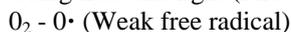
In 1976, Nutting and Poe introduced the walking bleach technique, which uses 35% hydrogen peroxide and sodium perborate for whitening non-vital teeth. In 1968, Klusmeier described a technique using Gly- Oxide, a 10% carbamide peroxide oral antiseptic, which he placed in the orthodontic positioners of some patients to improve gingival health.⁸

BLEACHING CHEMISTRY

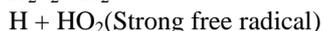
The exact bleaching/whitening mechanism is not fully understood but is thought to involve the ingress of oxidizers and oxygenating molecules via enamel micro pores along a diffusion gradient and via direct access of dentine. These reduce or cleave pigment molecule double bonds either to break down pigments to small enough molecules that diffuse out of the tooth, or to those that absorb less light and appear lighter. Hydrogen peroxide forms a loose association with urea to produce urea peroxide (carbamide peroxide) which is easily broken down in the presence of water to release free radicals that penetrate through the enamel pores and into the dentine to produce the bleaching effect. The breakdown of hydrogen peroxide into free radicals that penetrate through the tooth occurs via photo dissociation, anionic dissociation or a combination of the two once the process starts. Once the initiation has started both types of dissociation may occur.⁵



Using heat and light (Photo dissociation)



(b) With high pH and accelerator (Anionic dissociation):



VITAL BLEACHING

Four different methods for tooth whitening have been recognized and reviewed by Barghi (1998):

- dentist-administered bleaching—the use of a high concentration of hydrogen peroxide (from 35 to 50%) or carbamide peroxide (from 35 to 40%), often supplemented with a heat source;
- dentist-supervised bleaching—by use of a bleaching tray loaded with high concentrations of carbamide peroxide (from 35 to 40%) that is placed in the patient's mouth for 30 min to 2 hrs while the patient is in the dental office;
- dentist-provided bleaching— known as "at-home" or "night-guard" bleaching and administered by the patient applying from 5 to 22% solution of carbamide peroxide in a custom-made tray; and
- over-the counter products, often based on carbamide peroxide or hydrogen peroxide of various concentrations and placed in a pre-fabricated tray, or

by the recently introduced strips (Gerlach, 2000), both to be adjusted by the user.⁴

In-office bleaching is useful in removal of stains throughout arch, or a single tooth or specific areas in a tooth. Other names associated with in office bleaching are Chair side bleaching, power bleaching, dentist administered/applied bleaching (Barghi 1998), assisted bleaching (Miller 1999). Materials available for bleaching are: 35% hydrogen peroxide or 10% carbamide peroxide or a combination of these two materials. A high concentration of hydrogen peroxide is administered to the teeth with an activating method (heat, light or laser) to expedite the whitening effect. Hydrogen peroxide acts both as an oxygenator and an oxidant.⁹ It is often referred to as "one-hour bleaching". In-office bleaching can be done as either a one-visit of 1–1.5 hour treatment or a multiple visit procedure. The use of high concentration hydrogen peroxide gels intra orally requires specific safety protocols. First, the doctor and patient must wear some eye protection, and a barrier must be placed for the gingival soft tissues adjacent to the procedure. As some types of lights generate heat and or UV rays, a rubber dam napkin is used to shield the face from the light source. Some of the manufacturers provide moisturizers for the lips or sun screen as protection from the UV rays. Although a dental dam would be ideal, the placement on a dental dam will inhibit the bleaching of the cervical areas of the teeth, which will dissatisfy patients.¹⁰

METHOD OF APPLICATION

- The teeth are cleaned with pumice slurry.
- Isolation is done with rubber dam.
- A thick layer of bleaching gel is applied on teeth with the brush applicator.
- Bleaching gel is left for few minutes.
- Photo-activation of the bleaching gel with light is done.
- Cleaning is done.
- Final polishing is done.

In 1989, Haywood and Heymann developed the at-home technique of dental bleaching using 10% carbamide peroxide in plastic night guards; they recommended 6-8 hour applications. The original at-home bleaching products used a 10 % solution of carbamide peroxide as the bleaching agent, which are basically 3 percent hydrogen peroxide and 7 % urea. The urea primarily acts as a stabilizer to give these products a longer shelf life, slow release of the hydrogen peroxide and other benefits. This type of treatment achieved satisfactory whitening in 2-6 weeks. At-home tray bleaching has become a frequently used whitening techniques, for slight to moderate discolouration rather than in the case of more severe discolouration.¹¹

MECHANISM OF ACTION

10% carbamide peroxide ($\text{CH}_6\text{N}_2\text{O}_3$) releases 3.35% hydrogen peroxide (H_2O_2) and 7% urea in a hydrophilic environment. The urea elevates the pH of the mouth,

imparting antibacterial and bacteriostatic properties. $\text{CH}_6\text{N}_2\text{O}_3$ is reported to be more antibacterial than 0.2% chlorhexidine *in vitro*. H_2O_2 is the active ingredient, being a powerful oxidising agent, in the presence of water it produces free radicals and nascent oxygen.

These small molecules can pass freely through and penetrate the enamel and dentine to decolour or solubilise the chromogenic material within the tooth structure. It is thought that the bleaching action is achieved by breaking down large coloured molecules that cause staining (by cleaving or reducing double bonds) into smaller molecules. These smaller molecules are then either small enough to diffuse out of the tooth structure or absorb less light and appear lighter. H_2O_2 degrades over time, with a reported 50% being available after two hours.¹²

INDICATIONS

- Generalized staining;
- Ageing;
- Smoking and dietary stains such as those of tea and coffee;
- Fluorosis;
- Tetracycline staining;
- Traumatic pulpal changes.⁵

ORAL AND OTHER CONDITIONS THAT CONTRAINDICATE TOOTH WHITENING

- Dry Mouth;
- Enzymatic Disorders;
- Respiratory or Digestive Tract Disorders;
- Asthma;
- Allergy to Vinyl;
- Hypersensitivity to Hydrogen Compounds;
- Mouth Breathing;
- Unrestored Tooth decay;
- Patients' high expectations;
- Decay and periapical lesions;
- Pregnancy;
- Sensitivity, cracks and exposed dentine;
- Existing crowns or large restorations in the smile zone;
- Elderly patients with visible recession and yellow roots.
- Frankly Exposed Root Surfaces;
- Broken Teeth;
- Severe enamel erosion due to acidic or carbonated drink intake or gastric regurgitation
- Parafunctional Grinding;
- Poor oral hygiene.^{5,13}

CONCLUSION

The importance of tooth whitening for patients and consumers has seen a dramatic increase in the number of products and procedures over recent years. A number of approaches are available for measuring changes in tooth colour. However bleaching with agents like hydrogen

peroxide or its precursor can cause adverse effects such as cervical resorption of root. Dentist who performs these procedures should be aware of all the complications that can arise and should discuss the pros and cons of tooth whitening with the patients before undertaking the procedure. Vital tooth whitening, when administered correctly, is one of the safest, conservative, least expensive, and most effective aesthetic procedures currently available to patients.

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