



OVERVIEW OF IN-OFFICE BLEACHING OF VITAL TEETH

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ABSTRACT

The importance of tooth whitening for patients has shown a dramatic increase in the number of products and procedures over recent years. Vital tooth bleaching refers to chair-side clinical application of a chemical solution to a tooth surface in order to achieve whitening effect of the teeth. Vital bleaching have found to be very effective but they also have their drawbacks. The current article gives knowledge of vital tooth whitening with respect to external bleaching methods. the external bleaching of vital teeth focuses on patient selection, mechanisms, bleaching procedure and various in-office bleaching systems and techniques and their disadvantages

Keywords: Halogen light, Plasma arc light, Laser bleaching, Chemical Bleaching

INTRODUCTION

Tooth plays a major role in the beauty and personality of an individual. Tooth whitening has become increasingly popular and the desire for whiter teeth has become global. With the advantage of new materials and techniques, dentists can often meet or even exceed the expectations of the patients. Color of the tooth is of particular importance to the patient because of social and psychological concern.

Chairside bleaching technique has always been a challenge as the treatments results were uncomfortable for the patients due to the lengthy time required for the process and also because its effectiveness is not long term¹. Yet, patients seek for immediate results.

The benefit of chairside whitening procedures for the dental office is that they can be implemented by auxiliary staff and the average color change per appointment has been reported to be 2.1 to 3.7 units on a 16-scale VITA Classic shade guide

(Vident)^{1,2}. The demand for tooth whitening procedures is high enough that, for most dentists, tooth whitening procedures are a “must have” in their dental clinic.

DETERMINING THE ETIOLOGY OF DISCOLOURATION

Most discoloration falls primarily into one of three categories. The most common staining is

- Extrinsic stains are superficial, resulting from excessive use of food substances such as coffee, tea, highly colored food or tobacco³.
- Intrinsic stains are discolorations of the tooth structure that may occur due to ingestion of certain drugs, excessive exposure to fluids, or exposure to dental restorative materials⁴.
- Age related discoloration usually results from a combination of extrinsic staining thinned enamel and darkened dentin⁴.

Colours produced by various causes of tooth discoloration

Types of discoloration	Color produced
Extrinsic stains Plaque/poor oral hygiene Tea, coffee and other foods Chlorhexidine Mouthwash Cigarettes/cigars	Yellow/ brown Brown to black Black and brown Yellow/ brown to black
Intrinsic Stains Fluorosis Tetracycline medication Amelogenesis and Dentinogenesis imperfecta	White, yellow, grey or black Brown and black banding appearance Brown and black
Stains due to trauma Pulpal haemorrhage products	Pink spot
Aging Internalized Caries Restorations	Yellow Orange to brown Grey and black

PATIENT SELECTION

Diagnosis of the etiology of tooth discoloration plays a major role in the success of any tooth bleaching. It also depends on the conditions of the teeth like

- Decay, Size and vitality of the pulp to predict sensitivity levels and even presence of any periapical pathology⁵ and personal factors like
- The individual patient's desires and expectations about the esthetic outcome

- Willingness to spend time in the dental chair and or to co-operate at home; and
- Acceptance of responsibility to modify behavior that can affect tooth coloration⁶.

THE BLEACHING MATERIALS

There have been numerous changes to materials since home bleaching materials were introduced. First generation materials were in liquid form. These materials did not remain in trays for a long time. Eg. Glyoxide⁷.

Second generation materials are currently available which are more viscous and in gel form. This is to stop materials leaching out of tray and causing soft tissue irritation Eg. Proxygel⁷.

Third generation differs in their vehicle and color.

Constituents of Bleaching^{8,9}

- Carbamide peroxide -10% - 35%
- Hydrogen peroxide and sodium hydroxide – 10 – 50%
- Non- hydrogen peroxide containing materials i.e. sodium perborate
- Thickening agent carbopol or polyx- helps in slow release of oxygen molecules from gels and prolongs the action of the bleaching material.
- Urea-its used to stabilize hydrogen peroxide and elevate the ph of solution
- Vehicle(glycerin, dentifrice, glycol)- enhances viscosity of the bleaching gel
- Surfactant- enhance wetting ability and penetration of hydrogen peroxide into the tooth
- Preservatives- gives bleaching material better stability and durability
- Flavorings- to enhance patient acceptability
- Fluoride(in recent products to reduce sensitivity)

MECHANISM OF BLEACHING

Mechanism of whitening by oxidizing agents is not actually understood. The technique works by lightening the enamel to give the appearance of whiteness.

One theory states that the large colored organic molecules responsible for the stains are reduced to smaller, less noticeable molecules by the oxidation process. The hydrogen peroxide acts both as an oxygenator as well as oxidant^{10,11}.

Another theory is that the peroxide penetrates into enamel and dentine and oxidizes tooth discolorations. The passage of nascent oxygen into the tooth structure occurs first in enamel and then in dentine^{11,12}.

BLEACHING PROCEDURE

- Patient is assessed clinically and radiographically
- Shade assessment with the teeth being wet and dry
- Proposed treatment planning is done
- Pre operative photographs of teeth are taken
- Isolation: there are many forms of isolation that can be used, depending on the type of bleaching procedure used, or the dentist's particular preference.
 - Rubber dam is a good method of isolation . Ligation of the teeth are done with waxed dental floss to prevent seepage of the fizzing hydrogen peroxide solution through to the underlying tissues
 - Opal dam (Ultradent Products, South Jordan, Utah, USA). These are light cured resin barrier materials that are painted on to the gingiva around and in between the teeth to be bleached.
- Soft tissue retraction:
 - Cheek and lip retractors are placed to pull these tissues away from the teeth and bleaching gel.

-NOLA Full Arch isolation (NOLA Full Arch isolation, Orthocare-UK) within built suction facility

- Tongue guard to prevent the forward movementof the tongue on to the teeth and bleaching gel.
- Gauze and cotton wool rolls placed inside the lips and cheeks to keep them away from the gel
- Teeth are cleaned with pumice prophylaxis paste
- Bleaching material is now applied to the teeth. 2–3 mm layer of freshly mixed gel should be applied to all the labial surfaces of teeth in the smile zone and lipped over to cover the incisal edge, smile zone varies from patient to patients but is commonly from the first or second premolar
- Activation with or without a light source depends on the bleaching system used

-If Light is used they are applied close to the teeth

- If laser is used Gel is placed at a thickness of 1-2 mm on to the buccal surface of the teeth to be bleached laser light is applied for 30 seconds about 1-2 cm from the buccal surface of each tooth. Laser light is applied slowly for 30 seconds and moved from right to left over the tooth's surface.

-If plasma arc light is used, the light is applied 6-7 mm away from the gel. It emits 3 seconds bursts of light, which is applied on to each tooth in turn. This is generally continued for a period of three, 3-minute interval (depending on instructions) or 10-15 minutes, and the bleach is removed from the teeth via the high volume aspirator.

- The gel is left in place for a length of time dependent on the system and concentration of hydrogen peroxide used, usually about 10 minutes, but can range from 3–20 minutes at a time¹⁰.
- Teeth are then washed, and the bleach is reapplied for a further 10 minutes and the process is repeated for 45 minutes to 1 hour.
- Teeth are polished with diamond polishing paste or aluminum oxide discs.
- Dam is then removed. Mouth is rinsed and shade of the teeth is now assessed. A postoperative photograph can be taken.
- Application of a neutral colourless fluoride gel may help in cases where there was sensitivity experienced during the procedure^{7,13}.
- Patient is called 3-6 weeks later and this process can be repeated in 6 weeks increment until the desired shade is achieved.
- Patients should be given postoperative instructions:
 - Use of a fluoride gel or potassium nitrate containing toothpaste in cases that experience thermal sensitivity.
 - Dietary advice to avoid acidic drinks, fruits, tea, coffee and smoking for 48 hours. It is thought that the oxidizing free radicals are still active within the teeth for a further 48 hours post bleaching
 - Shade regression of about half a shade unit tends to occur about a week to ten days post bleaching. Patients should be made aware of this to avoid disappointment.
- Top up home bleaching kits should be given to those cases that require further bleaching.

CHAIRSIDE BLEACHING SYSTEMS

Curing Lights

Different types of curing lights are used for the activation of the bleaching gel. Initially, it was the conventional curing

lights but then these were quickly joined by lasers and plasma arc lamps. In addition others utilize a dual activation system.

Halogen Light

Curing lights system has been widely used in dentistry for bleaching. This in-office bleaching system is a xenon-halogen bleaching light that launch a blue-green coloration.

Halogen light bleaching system uses 35% Hydrogen Peroxide that contains carotene that converts light energy to heat and therefore increases the activation of the hydrogen peroxide based bleaching compound with a pH of 5.5³⁵.

Each bleaching session in-office is broken down into three individual applications, with the duration of each application being 8 minutes. It means that the cumulative exposure to the gel is 24 minutes to delivers 2 - 4 shades^{14,15,35}.

Metal Halide Lamp

Metal halide light produced from fired up mercury atoms to activate and boost the teeth whitening solution. It is incorporated with an IR (infra-red) filter and emits insignificant amounts of UV(ultra-violet) emissions to minimize heat at the surface of the tooth. Its makes use of specific peroxide-based gel and it is provided an activator³⁴.

These two resources are combined together during the whitening procedure creating whitening gel that is very basic (features a pH range that's usually somewhere between 7.5 and 8.5) and is 25% hydrogen peroxide. This technique employs three 20-minute passes followed by the application of sodium fluoride gel^{15,22}.

Plasma Arc Lamp

Plasma is the fourth state of matter, Plasma arc lamp was introduced in 1993; it consists of charged particles, radicals, and a strong electric field. Plasma has potential biomedical applications because it is non thermal and nontoxic and can be realized in a simple hand-held device . Furthermore, it also generates energetic ions, free electrons, and hydroxyl radicals (.OH) that contribute significantly to tooth bleaching, so that plasma might have a synergic effect on tooth bleaching by H₂O₂¹⁶.

Tooth bleaching method with plasma that we can be complementary to the conventional method because it provides effective bleaching without thermal damage

Gas Plasma Light

Gas plasma light system which consists of a lamp filtered to emit light in the blue-green region of the spectrum (approximately 400-500 nanometers) and a patented delivery device, which illuminates all smile teeth at once^{15,17}.

The Gas Plasma Light is used in combination with a patented peroxide gel, which has been optimized to obtain a maximal whitening effect and to ensure patient safety^{10,17}.

The patented chemistry consists of a 15% hydrogen peroxide gel buffered at an approximately neutral pH that is compatible with tooth enamel. The gel also contains other ingredients such as glycerine and highly purified water to prevent tooth dehydration and to further ensure safety. The gel also contains a patented photo-initiator, which assists in chromophore destruction at the tooth's surface^{17,18}. The plasma light technique consists of two 20 mins cycle.

A study by the prestigious Forsyth Institute also confirmed the 9+ shades average improvement achieved using the BriteSmile process¹⁷.

Plasma Arc Light Source

The plasma arc light employs a hydrogen peroxide-based bleaching gel and has a 25% Hydrogen Peroxide, a pH of 8.5. The higher doses of peroxide make the mix stronger, and better able to remove stuck-on stains, like coffee, tea or cigarettes^{19,22}. The plasma arc light system consists of one 30

mins cycle, after the 1st cycle within results are evaluated and it is determined if 2nd 30 mins cycle is necessary.

Chemical Activated Bleaching

Chemically-activated in office bleaching agent. Its based on 38% hydrogen peroxide two part gel system²¹.

It consists of one syringe, containing hydrogen peroxide, which is mixed with the second syringe and is chemically activated, activation is due to a unique proprietary activator that increases the pH to 7 for maximum activation. When mixed together, the bleaching agent is supercharged that does not require light or laser activation^{22,35}.

Teeth typically become at least 6 - 10 shades whiter. Chemically-activated in office bleaching technique consists of 3 cycles of 10-15 mins each.

Laser Bleaching Technique

The word "laser" is an acronym for light amplification by stimulated emission of radiation.

Laser bleaching officially started in 1996 with the approval of Ion Laser Technology's argon and carbon dioxide lasers by the FDA. There is little data to prove that lasers are more effective than the traditional bleaching methods.

- Carbon dioxide (10600 nm)
- Nd:YAG
- Er: YSGG
- Argon (515 nm)
- Diode (980 nm)
- KTP (532 nm)
- Combinations

These units create output that lies in the near-infrared portion of the spectrum (In comparison, most bleaching units primarily emit visible light).The use of one these lasers is that their output (a specific wavelength) "activates" a catalyst within the whitener that, in turn, increases its effectiveness²⁰.

Laser Whitening Gel is a unique mix of laser activated Crystals integrated into a gel of highly processed Fumed Silica and 35% Hydrogen Peroxide^{20,36}.

This translucent, semi-viscous bleaching gel is applied to the teeth and a high intensity light source (laser light) is used to activate the Crystals to absorb the thermal energy from the light and allowing better disassociation of the oxygen to better penetrate the enamel matrix and increase the lightening effect on the teeth²⁰.

In this system Gel is laser-activated in 15-second intervals and repeated as necessary. The laser can be exposed to a few teeth at a time.

The effect of shade change of chemical oxidation, Light Activation and Laser technique are the same but the bleaching time required for Laser system is comparatively lesser compared to the other two systems and there is no effect on the longevity of the process of bleaching³⁵.

BLEACHING TECHNIQUES

Waiting Room Bleaching Technique

In this technique 35% carbamide peroxide (which breaks down to 10% hydrogen peroxide) is used as a bleaching agent. The teeth are polished with prophylaxis paste. The 35% carbamide peroxide is heated gently by holding the syringe under hot running water for 2-3 minutes. Heat of the syringe accelerates the activity of the material before it is loaded into the mouth guard. The 35% carbamide peroxide is placed into a custom made bleaching tray⁶.

After excess material is removed, the patient is seated in the waiting room for a period of about 30 minutes with the bleaching tray in the mouth. After 30 minutes, bleach is suctioned off the teeth before rinsing⁶. This procedure can be repeated 2-3 in a single session.

Compressive Bleaching Technique

Miara (2000) suggested that the power bleaching technique could be made more effective by compressing the bleaching material on the tooth. In this technique nascent oxygen must be guided under pressure for permeation of the oxidizing ions through the enamel. It recommends to use 35% hydrogen Peroxide in a bleaching tray, sealing the tray edges with light cured resin to prevent damage to the soft tissues²⁰. The gel is either activated by halogen light or plasma arc light.

This is a relatively new technique and is undergoing clinical evaluation. One of the major concerns about this technique is probable penetration of hydrogen peroxide into the pulp chamber after only 15–20 minutes²⁴.

Dual Activated Technique

The in-office bleaching system is activation by combination of both light and chemical activation. It consists of ferrous sulphate, which serves as a chemical activator that completes the bleaching process in 7-9 minutes²⁵. In addition, the formulation also includes manganese sulphate, which is light activated and can accelerate the bleaching process to as little as 2-4 minutes. This technique uses hydrogen peroxide in a strong concentration of 19-35%²⁵.

Activation time

Chemical activation: approx. 15-20 mins

Light activation: 8-10 mins

DISADVANTAGE OF VITAL TOOTH BLEACHING

- Because of the causative nature of the bleaching agent isolation is necessary.
- Dehydration of the teeth causes a falsified lighter shade immediately post bleaching procedure²⁶.
- The bleaching procedure is can work out expensive for the patient.

EFFECTS OF BLEACHING AGENT

Dental tissue and Oral mucosa

Whitening effects of hydrogen peroxide on teeth and oral mucosa have been documented. Number of cases show undesirable effects such as hypersensitivity (2.62–3.38%) and gingival irritation (0.23–0.85%) have been reported²⁷.

Changes are also seen in enamel microhardness, micromorphological defects due to demineralization, and effects on restorative materials have also been reported^{28,29,30}.

Tooth sensitivity

Tooth sensitivity is a common side-effect of external tooth bleaching. Data from various studies of 10% carbamide peroxide indicate that from 15 to 65% of the patients reported increased tooth sensitivity³¹.

Higher incidence of tooth sensitivity (from 67 to 78%) was reported after in-office bleaching with hydrogen peroxide in combination with heat. Tooth sensitivity normally persists for up to 4 days after the cessation of bleaching treatment,

but a longer duration of up to 39 days has been reported^{32,33}.

Tooth sensitivity was also a common symptom in patients who had not bleached their teeth, and their symptom was correlated with **gingival recession**³⁴. Patients with a previous history of tooth sensitivity may thus have a higher risk for such an adverse effect from external tooth bleaching, and this should be taken into account before treatment begins.

CONCLUSION

In office bleaching techniques are used in patient who seek immediate results and do not wish to spend more time on achieving results from home bleaching systems. Owing to the caustic nature of the 35% hydrogen peroxide meticulous care should be on performing bleaching.

For better effect of bleaching more than one visit would be required, the results vary from patient to patient for many one visit would be enough to satisfy the aesthetic needs of the patients and a second visit wouldn't be necessary

In office techniques with easier and simpler isolation methods and improved bleaching gels and improved whitening lights have made bleaching results very efficient. Improved bleaching materials and technique, as described above, result in less sensitivity and better.

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