

An Update on Vital Bleaching

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Abstract

Today's society dictates that it is the norm for people to have sparkling white teeth. The demand therefore for tooth whitening in dental practice has increased exponentially over the last decade. A common approach to achieving this goal is by dental bleaching. This article discusses clinical aspects of vital bleaching by providing an evidence-based review of current literature. Topics covered include different types of bleaching materials and techniques. The aim of this review is to discuss the concepts involved in vital bleaching of teeth and to provide advice based on the evidence from current literature, to reduce the risks of complications and to ensure successful bleaching therapy.

Key Words : Vital Bleaching, Bleaching techniques, Bleaching Systems.

Introduction:

Bleaching is a proven practice-builder for the esthetic dentist and a confidence-builder for the patient. The goal of modern dentistry is maximum preservation of tooth substance with excellent aesthetics. Bleaching alone or in combination with minimally invasive adhesive dentistry fulfils this goal very often without the need to progress to the much more destructive techniques of veneers, crowns and bridges. With the advantage of newer materials and techniques, dentists can often meet or even exceed the expectations of the patients¹

Tooth bleaching is best performed under professional supervision and following a pre-treatment dental examination and diagnosis. In consultation with the patient, the most appropriate bleaching treatment option(s) may be selected and recommended based on the patient's lifestyle, financial considerations and oral health.

Matrix Bleaching

This technique has been widely advocated as a home bleaching technique, with a wide variety of materials, bleaching agents, frequency and duration of treatment. This out-of-the-office technique for lightening teeth also has been referred to as matrix bleaching, nightguard vital bleaching, and dentist-prescribed/home-applied bleaching. Numerous products are available, mostly containing either 1.5 to 10% hydrogen peroxide or 10 to 15% carbamide peroxide that degrades slowly to release hydrogen peroxide. Carbamide peroxide is the most commonly used active ingredient in home bleaching systems². Higher concentrations of the active ingredient are also available and may reach up to 50%. Typically, nightguard vital bleaching will attain optimal lightening in approximately 2 to 6 weeks. Daytime use typically consists of 1- to 2- hour applications

one to two times a day.

In-Office Bleaching

In office bleaching is also known as 'Chairside Bleaching'. Chairside bleaching technique has always been as a challenge as the treatment results were uncomfortable for the patients due to the lengthy time required for the process and also because its effectiveness is not longterm. Yet, patients seek for immediate results.³

Bleaching Using Mc Innes Solution

New Mc Innes solution contains 20% NaOH instead of HCl due to its deleterious effects.

Thermo/Photo Bleaching

This technique basically involves application of 30 to 35% hydrogen peroxide and heat or a combination of heat and light or ultraviolet rays to the enamel surface. The temperature should be at a level the patient can comfortably tolerate, usually between 52 degree Celsius to 60 degree Celsius. Dehydration of the teeth causes a falsified lighter shade immediately post bleaching procedure⁴.

Power Bleaching

In this technique, high intensity light, which was used as a heat source, is replaced with conventional halogen units, plasma arc lamps, LED lights, Xe-halogen lights and lasers. Power bleaching works by the permeation of oxygenating per hydroxyl free radicals through enamel micro pores along a diffusion gradient and into the dentine where it oxidizes the stains and thereby bleaches the teeth.

Some manufacturers have tackled the problem of dehydration by using lower concentrations of hydrogen peroxide (15%), which is a water-based solution, thereby increasing the water content by 20%. Contact of the bleaching agent with the teeth is for three 10-minute cycles, often known as passes. Power bleaching procedures usually involve three 10-minute passes, but these systems with lower concentrations of hydrogen peroxide use three or four 20-minute passes, while others use 3-minute passes repeated five times with total bleaching time being 15 minutes.

Curing Lights

Various types of curing lights are used to activate the bleaching gel or expedite the whitening effect. Initially, conventional curing lights were used but these were quickly joined by lasers and plasma arc lamps. In addition, some systems are activated by a chemical reaction on mixing two gels, while others utilize a dual activation system.

Halogen Curing Lights

Curing lights such as 'Demetron 501', can be used with a number of different

systems such as 'Pola Office' or 'Quick White'. 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 deliver 2-4 shades^{5,6,7}. Halogen light bleaching systems uses 35% hydrogen peroxide that contains carotene, which converts light energy to heat and therefore increases the activation of the hydrogen peroxide based bleaching compound with a ph of 5.5⁷.

Plasma Arc Lamp

Plasma generates energetic ions, free electrons and hydrogen radicals that contribute significantly to tooth bleaching, so that plasma might have a synergic effect on tooth bleaching by H₂O₂⁸.

Systems that use these lights are usually based on three 10-minute passes with light activation in whitening mode for 3 sec per tooth performed twice during the pass. Alternatively, a full smile adaptor is used to illuminate both arches together for the full 10-minute pass with the light switching on and off in 5-sec bursts but giving out lower intensity.

Xe-Halogen Technology

These systems utilize a full smile illuminator placed a few centimeters in front of both arches to activate 35% hydrogen peroxide gel with the usual protocol being three 10-minute passes. However, the use of a combination of carbamide peroxide (22%) and hydrogen peroxide (38%) for 20-minute passes repeated three times has been recommended, but this protocol must be questioned in terms of possible penetration into the pulp chamber and whether there is any benefit in combining 22% carbamide peroxide, which breaks down into approximately 7.5% hydrogen peroxide.

Laser Bleaching

Laser Bleaching can be an option for some patients who want dramatic whitening effect. Using the 488-nm argon laser as an energy source to excite the hydrogen peroxide molecule offers more advantages than other heating instruments. Argon lasers emit fairly short wavelengths (488 nm) with higher energy photons; conversely, plasma arc lamps, halogen lamps, and other heat lamps emit short wavelengths as well as longer invisible infrared thermal wavelengths (750 nm to 1 mm) with low-energy photons and predictable high thermal character.

Diode Lasers

Both 830 nm and 980 nm wavelength diode lasers can be used for tooth bleaching in combination with 35-50% hydrogen peroxide gel. Laser whitening gel is a unique mix of laser activated crystals integrated into a gel of

highly processed fumed silica and 35% hydrogen peroxide^{9,10}. Blue dye is also added to the gel as it absorbs the laser wavelength and heats up to cause the controlled breakdown of the hydrogen peroxide to oxidizing per hydroxyl free radicals.

The system is also based on applying 2-3mm of gel to teeth in the smile zone and three 10-minute passes with activation using 1-2 W of laser energy for 30 sec per tooth. It is essential that all present, including the dentist, patient and nurse are correctly protected with eye protective glasses as ocular damage is a real risk with the use of these lasers.

The research has focused on the application of the plasma-arc lamp as a curing source for photo initiating a camphoroquinone-tertiary amine-type composite system.

Metal Halide Lamp

It makes use of specific peroxide based gel and it is provided an activator.¹¹ The Zoom light is used with a two part 25% hydrogen peroxide gel in a dual arch technique. This technique employs three 20-minute passes followed by the application of sodium fluoride gel.^{6,12}

Chemical Activation

It is based on 38% hydrogen peroxide two part gel system.¹³ It consists of one syringe, containing hydrogen peroxide that is chemically activated by mixing with the second syringe, containing a unique proprietary activator that increases the Ph to 7 for maximum activation. When mixed together, a supercharged bleaching agent is produced that does not require light activation. Example is systems such as Opalescence Xtra Boost

Dual Activated Systems

'Hi-Lite' is a system that contains both ferrous and manganese sulphate, which are chemically, and light activated, respectively, to accelerate the bleaching process to 7-9 minutes. This technique uses hydrogen peroxide in a strong concentration of 19-35%¹⁴.

The system is based on 35% hydrogen peroxide blue gel that is activated using a conventional light-curing unit. After about 2 minutes, the gel changes color to green, following oxidation, and then to cream, before finally becoming chalky colored. At this point it is removed and a fresh mix is applied, with the procedure being repeated up to six times in one session.

Waiting Room Bleach Technique

Thirty-five percent carbamide peroxide

is activated by holding the syringe under hot running water for a few minutes prior to use. The gel is placed in the custom-made tray, which is then put in the mouth of the patient where the excess material is removed. The patient is then asked to sit in the waiting room for about 30 minutes. After 30 minutes, bleach is suctioned off the teeth before rinsing¹⁵. The procedure can be repeated 2-3 times more in one session.

Compressive Bleaching Technique

This technique suggests that the power bleaching technique can be made more effective by compressing the gel against the teeth. This is based on the observation that, on decomposition of the power bleaching gel, small bubbles appear in the gel that indicate the release of oxygen ions and, unlike in home bleaching techniques, these ions migrate and a some of them will permeate the enamel. In order to enable the permeation of oxidizing ions through the enamel, the nascent oxygen must be guided under pressure.

The procedure involves the usual isolation and placement of 35% hydrogen peroxide gel, such as 'Opalescence Xtra', in a custom-made tray, which is put in place and any excess material is removed before the lingual and buccal edges of the tray are sealed with light cured resin material, to prevent any leakage during gel decomposition. Once the edges are sealed, the gel is activated using either a halogen light or a plasma arc lamp. After 30 minutes, the gel and isolation are removed and the teeth are washed, with the procedure being repeated on another occasion, using home bleaching with 10% carbamide peroxide in the interim for maximum results. This technique is relatively new and is undergoing clinical evaluation. Concerns with this technique include the probable penetration of hydrogen peroxide into the pulp chamber after only 15-20 minutes¹⁶. In addition, there is no proof that the presence of the tray will force the nascent oxygen back into the tooth to enhance the bleaching procedure as hypothesized.

Combining Bleaching Techniques

Combining different bleaching techniques serves a number of purposes including improving the effectiveness of the whitening procedure, especially when there are stains of varying etiology or cases of tetracycline staining. It is also used to motivate those patients whose compliance levels for home bleaching is questionable. The patient is encouraged by the almost immediate results produced by power

bleaching to continue with top-up home treatment to achieve maximum whitening results. It is also desirable to combine techniques in cases where a non-vital tooth is involved or single teeth with multiple stains.

Ultrasonic Technology

The latest addition to the bleaching systems is the 'SoniWhite Whitening System', which utilizes ultrasonic technology with a 6-7.5% hydrogen peroxide gel in upper and lower trays. The procedure only involves approximately two cycles of 5 minutes but it is thought that the use of the ultrasonic energy indirectly encourages the production of more oxygen-free radicals that permeate through the tooth to produce the whitening effect.

Over-the-Counter Kits

- Whitening strips
- Whitening gels
- Tray-based bleaching systems

Conclusion

Tooth bleaching is one of the most conservative and cost-effective dental treatments to improve or enhance a person's smile. Data accumulated over the last 20 years also indicate no significant, long-term oral or systemic health risks associated with professional at-home tooth bleaching using materials containing 10% carbamide peroxide, which is equivalent to 3.5% H₂O₂. Tooth sensitivity and gingival irritation can occur in a significant portion of the patients, although in most cases they are mild to moderate and transient. When gels of high H₂O₂ concentrations, such as those for in-office bleaching, are used without adequate gingival protection, severe mucosal damage can occur. Although rare, potential adverse effects are possible with inappropriate application, abuse, or the use of inappropriate at-home bleaching products. H₂O₂ is capable of producing various toxic effects, so that potential risks exist and need to be recognized.

So far, little data are available on the safety of OTC at-home bleaching that simulates the intended application mode of these products, and the safety of bleaching performed at mall kiosks, salons, spas, and cruise ships is of particular concern because the procedure is similar to that of in-office bleaching but performed by nondental individuals.

References

References are available on request at editor@healtalkt.com