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AESTHETICS

Tooth Whitening:

Addressing the Sensitivity Problem

Written by Peter D. Vastardis, DMD

Most of us fear the inevitable reality of growing old and losing our youthful vivacity. Nowhere is this more apparent than with that infamous demographic group, the baby boomers. With the dominance of this group in the population, the demand has grown exponentially for all types of cosmetic procedures. Plastic surgery, personal trainers, hair coloring, and hair transplants are but a few of the procedures this ravenous group demands daily in its search for sustained youth.

Baby boomers account for 28% of the US population. Nearly 77 million boomers are getting older, and approximately every 8.5 seconds another boomer turns 50.1 Television programs like Extreme Makeover, The Swan, and Dr. 90210 have not only increased ratings for their respective networks but have also shown viewers dramatic improvements in personal appearance through available and affordable advancements in medicine and dentistry. Most boomers are now in their peak earning years. They've raised their families, bought their houses and vacation homes, and are now looking for places to put a very high level of disposable income. Where better to make that investment than in improvements in one's appearance, an investment that can deliver returns in self-esteem and the perception of being successful to others?

Boomers are not the only group that covets whiter, brighter teeth. The younger generations are enthusiastically in pursuit of handsome smiles. As a result, the market has become flooded with over-the-counter whitening products. Crest Whitestrips (Procter Gamble) alone have to-date sales of approximately \$202 million dollars.[2](#)

For many, bright, white teeth is one attribute, if not the most important, of a youthful image. Cosmetic smile enhancement has become dentistry's most requested procedure, with an

increase of more than 300% in the last 5 years.³ In fact, a survey by the American Academy of Cosmetic Dentistry found that 85% of Americans believe that an unattractive smile makes a person less appealing to the opposite sex, and 74% believe that an unattractive smile can decrease the chance for career success. People know that although they may not become famous stars or models, they can certainly get their teeth as white as those they see in the media by visiting the dental office.

Many advancements in tooth whitening have been made over the last few years. Dentists have become much more familiar with the proper protocol for case selection. They can decide which case will be successful and which will be less than satisfactory.

However, despite the proliferation of dental whitening products and improvements in technology and procedures, one all-too-common problem has been persistent—the issue of tooth sensitivity that many patients suffer with. Dental professionals have accepted this as a normal byproduct of bleaching. Some dentists advocate administering anti-inflammatory drugs such as ibuprofen prior to in-office whitening to help alleviate the uncomfortable sensitivity many patients experience. Often, dental offices will receive calls from patients informing them that their teeth are extremely sensitive and their gum tissues highly irritated. The results are often poor compliance and loss of trust in the whitening procedure specifically, and even the dentist in general. More than once I have heard reports of a patient suffering sensitivity from a bleaching procedure, never to return to that practice again.

Reasons cited for sensitivity have included exposed dentin, excessive dehydration of teeth, and high temperatures from the in-office whitening light.⁴ Manufacturers have tried various formulations in an attempt to alleviate sensitivity, but Haywood found that the zero sensitivity products he tested were still causing sensitivity.⁵ Both increasing and decreasing the peroxide concentration in bleaching agents has been tried with limited results.

This article describes a case report in which a proprietary whitening system, which was developed to eliminate sensitivity due to bleaching, was used.

MATERIALS



Figure 1. Whitish blistering of tissues traditionally associated with bleaching was not present with GentleWhite. **Figure 2.** Before photo of patient showing severe tetracycline staining.

This case uses a new system called GentleWhite (Innovative Medical and Dental Systems [IMDS]), which recently arrived in the United States from Europe. The system incorporates a proprietary chemistry called Extracted Aqueous Barrier (EAB). The EAB formulation reportedly prevents peroxide contact with tubules and nerves. Enamel, which has low water content, would react very well to the bleaching agent, but dentin, with its higher water

content, would not allow the bleach to permeate it. The system basically reacts in the presence of water to form a chemical barrier across which the peroxide cannot pass. In addition, in the presence of gingival and other soft tissue (which have high water content) the bleaching agent does not burn, as can be seen with certain other dental bleaching agents in the form of whitish, blistering tissue (Figure 1). According to the manufacturer, the chemistry of GentleWhite bleach stabilizes the hydrogen peroxide and raises the pH to between 7.0 to 8.0 in the mouth. This higher pH, in combination with formation of the EAB, diminishes penetration of the hydrogen peroxide into the higher water content gingival tissues. Table 1 shows how the pH of unstabilized bleach varies with concentration.

Table 1. How pH of Unstabilized H₂O₂ Varies With Concentration.

% H₂O₂ Concentration	0	10	20	30	40	50	60	70	80	90	100
pH at 25°C	7.0	5.3	4.9	4.7	4.6	4.5	4.5	4.5	4.6	4.9	6.2

Being an advocate of the deep bleaching methods developed by Dr. Rodger Kurthy, I followed his procedures for this case, just as I normally do with my in-office bleaching cases. In order to really test this new GentleWhite system, I chose a patient with severe tetracycline staining (Figure 2).

CASE REPORT

I felt that if this product worked well with this difficult case, it would work in almost any other case. As always, an initial medical/dental examination of the patient with necessary digital radiographs was performed to determine the existing dental condition. The patient had recently visited his periodontist for dental prophylaxis. Oral soft tissue was examined as well by both this author and the periodontist. A series of digital photographs was taken via the American Academy of Cosmetic Dentistry recommendations⁶ with the Canon EOS-10D (6.3 megapixel) SLR digital camera with a 100-mm zoom macro lens and ring flash (NormanCamera.com) using necessary retractors and mirrors. Preoperative shade photos were taken as well.

Full-arch upper and lower alginate impressions were taken, poured in yellow stone, and trimmed. The Kurthy system was used for preparation of the models to fabricate bleaching trays, which were to be dispensed at the second appointment. This author highly recommends a review of Dr. Kurthy's manual, *Deep Bleaching, The Holy Grail of Teeth Whitening*, as it is an invaluable tool for the cosmetic dental practice.

At the second appointment, the patient was seated, and the preconditioning of his teeth was performed with absolutely no intraoral soft-tissue barrier except lip protection; eye protection was also provided. The patient never once felt any burning or discomfort. No anti-inflammatory premedication was required. It is a well-known fact that the enamel surface has minute channels that allow for diffusion of small molecules such as calcium, phosphate, acids, and fluoride.⁷ By preconditioning (priming) the enamel first with a quick, 2- to 3-second 35% phosphoric acid etch and an in-office bleaching agent, this author's experience has been that the take-home bleach works that much better, probably because it allows the oxygen bleaching ions to gain deeper penetration into the enamel surface. Although I always believed that the bleaching process depended on the concentration of the bleach and the

length of time the bleach remained on the tooth surfaces, reading Dr. Kurthy's book helped me to understand that permeability of the enamel surface to the bleaching agent was also a key factor.



Figure 3. Packaged/sealed in-office GentleWhite VHP bleaching product.



Figure 4. Unsealed 2-part premixed VHP bleaching agents.



Figure 5. Activated VHP bleaching gel immediately upon mixing.

The GentleWhite in-office system is called VHP (Variant Hydrogen Peroxide). It uses a 2-part process that is mixed at the time and place of use. The ingredients in each part are isolated from each other for efficacy and long-term storage. Once the contents are mixed, the solution is activated and the active life drops to a matter of hours. Mixing was easily accomplished, and the placement of the agent onto the tooth surface was quite easy. The bleaching agent's white, non-slumping, and toothpaste-like consistency made its placement on each tooth a simple process (Figures 3 to 5).

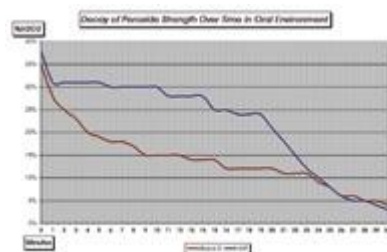


Figure 6. Effects of time on decay of hydrogen peroxide in the mouth.



Figure 7. IMDS PAC light is fully automated for hands-free, unattended in-office whitening.

With regard to the effect of the 2-part mix on efficacy, by separating the bleach into a viscous gel and a powder, the peroxide can be captured in micro-encapsulated form (this is the "variant"). This allows for timed release of the peroxide. The peroxide powder is composed of randomly sized cells, which also have randomly sized wall thicknesses. According to the

manufacturer, the bleaching effect of hydrogen peroxide is not linear over time. It is much higher when it initially contacts the enamel, then weakens with time. The use of timed release allows the peroxide to break down at a slower rate, allowing the high concentration of peroxide to continually make initial impacts, which are much more effective than the effects of peroxide that have been allowed to decay even for a relatively short period of time (Figure 6).

Once the gel was applied, the IMDS Cure Whiten 100 light (Figure 7) was used. According to the company, this light is FDA-approved for both in-office whitening and curing of composite in 3 to 5 seconds. In addition to a curing tip, it comes supplied with a full-arch bleaching tip that mounts to a stand for positioning in front of the patient's mouth. In its automated bleaching mode, the light cycles on for 60 seconds and off for 30 seconds over a period of 10 minutes, whereupon it emits a single beep reminding the operator to check the bleach for "œdroop" and to agitate the bleach slightly before restarting the light for another 10-minute cycle.

Certainly, one could use the Rembrandt Sapphire light unit (Den-Mat), which is still my favorite. Although recent studies show that the bleaching lights may be of questionable value in terms of intrinsic bleaching results, the psychological impact for the patient is significant and should not be overlooked by any dentist serious about in-office bleaching.



Figure 8. Whitening effect is shown even after relatively brief pre-conditioning session. See Figure 2 for before photo.

The patient was bleached for approximately 45 minutes, not the 60 minutes that most manufacturers recommend. The reason for this was that I simply wanted to precondition the enamel. If the patient did not have this severe discoloration, I probably would have stopped at 30 minutes. The patient, who is also a dentist, was previously informed that the color change would not be that drastic, as the deep bleaching would not occur until the final in-office session. I was quite surprised at the degree of whitening achieved in such a short visit, as can be seen in Figure 8.

The trays fabricated previously using the Kurthy method were tried in to make sure an air-tight seal around the teeth was present. Dr. Kurthy has demonstrated in hundreds of cases that pressure of bleaching gel against the tooth structure is of utmost importance. Again, the patient had absolutely no discomfort, and although some bleaching agent was inadvertently placed on the soft gingival tissue, no burning or sloughing was evident. The patient was advised to avoid colored beverages and staining foods over the next few weeks and to continue the whitening procedure using the GentleWhite take-home kits I dispensed to him.

Like Dr. Kurthy, my favorite toothpaste is Rembrandt Plus (Personal Products Company), and I advised the patient to use this exclusively during the treatment process. I advised the patient to perform the take-home bleaching over the next 3 weeks. Although some whitening systems can be worn overnight, the GentleWhite take-home system only requires approximately 20 minutes of wear time. Since the patient had severe discoloration, I increased the wear time to 2 hours per day. Table 2, provided by IMDS, shows the comparative values of the bleaching power of Gentle White.

Table 2. Equivalent Bleaching Power of 3 GentleWhite Products.		
GentleWhite Product	Bleaching Agent	Equivalent Whitening Power
VHP In-Office	38% Variant Hydrogen Peroxide	97% carbamide peroxide
Super 30 Take-Home	30% hydrogen peroxide	89% carbamide peroxide
QuickStick	sodium percarbonate	58% carbamide peroxide



Figure 9a. Frosty appearance after 3-second etching of enamel.



Figure 9b. Placement of activated VHP gel with syringe.

The patient returned for the final in-office bleaching session using the GentleWhite system. It was apparent that his teeth had noticeably lightened over the last few weeks, but I assured the patient that I would give him a truly white, bright smile. The teeth were gently pumiced. The lips were coated with a barrier of Vaseline Petroleum Jelly (Unilever), and the eyes were draped by placing UV-resistant goggles. Ultra-Etch 35% phosphoric acid (Ultradent) was applied on the facial surface of each tooth I intended to deep bleach for only 5 seconds. I usually choose 3 teeth at a time and then have my assistant immediately rinse the teeth prior to continuing to the next 3 teeth. This etching provides a direct path into the deeper enamel layers. Figure 9a shows the frosty appearance of the teeth immediately after removal of the etchant.

The GentleWhite in-office bleaching agent was mixed according to the manufacturer's instructions. Again, no barrier was placed intraorally. I simply painted the non-slumping

material on each tooth and positioned the light near the teeth (Figure 9b). A 1-hour session was provided. I continually asked the patient if he felt any discomfort, and he always indicated that he felt none.

At the completion of the session, the remainder of the bleach was suctioned off, and the patient was asked to rinse vigorously with only water. It is important to remember that the enamel permeability is high, and therefore the patient must not rinse with a colored mouthrinse. The final step was to seal the enamel surface and help return the natural gloss to the enamel layer. I always use Brush & Bond (Parkell), as this can be cured by any light source. Brush & Bond is a self-etching, 4-meta-based composite bonding agent, and according to the manufacturer, it provides a hybridizing film that is only about 9 μm . A single coat is all that is needed. I carefully made sure I placed this material on the entire facial surface, especially near the cervical area, so that I left no unsealed enamel that would certainly discolor.



Figure 10. Photo of patient after course of treatment. See Figure 2 for before photo.

The last step was the placement of DuraFinish (Parkell). This is a nano-filled brush-on glaze. It is perfectly clear, so there is no fear of getting that ever-so-slight yellow tinge. It also forms a union with the Brush & Bond that was previously applied. This surface sealant will eventually wear off, and patients are told not to disturb this coat. Final facial and intraoral photos were taken (Figure 10).

CONCLUSION

The bleaching system described was well accepted by my staff and the patient. In conjunction with bleaching, restorative measures can then follow to enhance the overall desire of the patient. By brightening this patient's teeth, a more conservative approach to restorative treatment could be instituted. The patient was interested in porcelain veneers. If the original tooth shade had been used, an aggressive reduction of sound, healthy enamel would have been necessary to allow for porcelain thickness to help mask the severe discoloration that the systemic tetracycline caused. Now, with successful dental bleaching, a conservative approach such as direct bonding or the use of Lumineers (Den-Mat) could easily follow.

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Dr. Vastardis maintains an active general dental practice in Garden City, NY, with an emphasis on restorative, aesthetic, and implant dentistry. He graduated from Tufts University School of Dental Medicine and is the founder of the consumer educational Web site Floss.com. He is a member of the ADA, American Academy of Cosmetic Dentistry, European Society of Esthetic Dentistry, Nassau County Dental Society, Academy of Osseointegration, and the International Academy for Sports Dentistry. He can be reached at (516) 326-0770 `begin_of_the_skype_highlighting` (516) 326-0770 `end_of_the_skype_highlighting` or peter@gardencitydentistry.com

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