

# A Comparison of At-Home and In-Office Bleaching

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## Introduction

In-office bleaching of teeth has been in use for approximately 125 years, with little change in science or technique during that time. When at-home "nightguard" bleaching using carbamide peroxide was introduced in 1989, it appeared that the in-office approach would quickly become extinct. However, there has been a recent resurgence in in-office bleaching, primarily due to aggressive marketing of various "high-tech" light sources such as lasers and plasma arc lights, coupled with claims of reducing bleaching time, even to a single office visit.

This article will examine at-home and in-office bleaching in terms of efficacy, safety and cost, and discuss their clinical indications and contraindications. Advantages and disadvantages of both techniques will be assessed, and treatment parameters as well as coping with side effects will be addressed. This author bases the following information on a thorough analysis of the literature combined with personal research and clinical experience.

## Mechanism of Action

The degree of tooth whitening that can be achieved during bleaching is dependent on the concentration of bleaching material used and the time that this material has to act without producing side effects. In-office bleaching uses 35 percent hydrogen peroxide as the "whitening" agent. Many people don't understand that hydrogen peroxide penetrates through the enamel, the dentin, and to the pulp in a matter of minutes. Bleaching using either in-office or at-home techniques is not mere surface treatment of the tooth, it is causing internal color changes. We are not simply taking out stains that have occurred after formation of the tooth, but are changing the inherent color of the tooth. We typically think of bleaching as an oxidation process, but the bottom line is we don't really know what gives a tooth its color, therefore, when we change the color we don't know exactly what we are changing. Bleaching doesn't appear to have an effect on hardness or structural integrity of the tooth, but there is no real scientific evidence regarding what is being affected during the color change process.

Hydrogen peroxide is very unstable.

Like the hydrogen peroxide one buys at the drugstore in an amber bottle, it foams and fizzes as soon as it contacts organic material. One question we must ask when assessing in-office bleaching is, can we leave a high concentration of hydrogen peroxide on the tooth long enough to achieve proper color change? This is the question that interfered with the popularity of in-office bleaching even in its early years. In-office bleaching was never very popular because of the danger to the patient and the dentist, the amount of time it took to do it, and the cost to the patient. The danger to the patient is the potential for tissue burns from the 35% hydrogen peroxide used, which can result from a leaky rubber dam or improper isolation technique. There are also questions about dangers to the pulp related to certain lights used and the heat generated.

At-home bleaching, when it appeared in 1989, had the same indications as in-office bleaching except that it was much less costly, and safer to the patient and dentist. The original at-home bleaching products used a 10 percent solution of carbamide peroxide as the bleaching agent, which is basically 3 percent hydrogen peroxide and 7 percent urea. The urea primarily acts as a stabilizer to give these products a longer shelf life, slower release of the hydrogen peroxide and other benefits. Thus, both in-office and at-home products use hydrogen peroxide, but they are not identical. The pure form of hydrogen peroxide penetrates the tooth more quickly than the pure form of carbamide peroxide. The basic mechanism of action is the same, but the formulation affects shelf life and time required for penetration of the tooth.

## Efficacy

Current in-office bleaching technique is basically the same as the technique developed between about 1880-1916, which uses 35 percent hydrogen peroxide with rubber dam isolation. The question is often asked, "How long does it take to effectively whiten teeth?" The answer is, "You bleach 'till they are white." In other words, every case is different, and the amount of time required to achieve the desired result will vary from patient to patient. As noted previously, in-office bleaching uses a much higher concentration of hydrogen peroxide than

does at-home bleaching, therefore the bleaching agent will penetrate the tooth more quickly with in-office bleaching. However, the literature shows us that when using in-office bleaching we must count on 2-6 visits with about 45 minutes application time per visit, with or without using a light, to achieve an effective result. And we must wait at least one week between visits due to tooth sensitivity. This can be a financial burden for the patient even if the dentist charges a fair hourly fee. Also, you must apply the rubber dam each time and hope it doesn't leak. Certainly, some patients will experience satisfactory results in a single in-office visit depending on the underlying cause of the discoloration. However, this is not the norm.

For at-home bleaching expect 2-6 weeks of treatment time. Some patients will achieve desired results in a few days, but most will take 2-6 weeks, and it is best to tell them to expect this. If they finish earlier the dentist is a saint...if it takes that long the dentist is a prophet. Treatment time will be longer for special situations such as tetracycline staining. With tetracycline staining, at-home treatment may require 2-6 months, or even longer. In such cases it is suggested that a monthly fee be established, and the patient must understand that lengthy treatment may be required. This author has experienced severe tetracycline staining cases that required up to 12 months of at-home bleaching treatment, but the results were spectacular.

For some patients who are willing to pay an additional fee, in-office bleaching can be appropriate as a "jump start" technique, where it is accomplished while the tray is being fabricated for at-home bleaching. This combination approach could shorten the treatment time. Also, if for some reason a patient cannot comply with wearing the custom tray designed for use with at-home bleaching, in-office bleaching is a viable treatment alternative.

Can you achieve as good a result with in-office bleaching as you can with at-home bleaching? You might, but most often you don't because of financial, tooth sensitivity and labor considerations. People tend to give up too soon. If the dentist and patient can persevere through the number of visits required for effective results, then equivalency with at-home bleaching is certainly possible. As for one-visit "Power Whitening" that is the focus of extensive marketing these days, this author has not had any such technique work to the level of what can be achieved with at-home bleaching. Another

problem with in-office bleaching is that you only bleach the anterior six or eight teeth. It is hard to place a rubber dam on second molars without it leaking during bleaching. Thus, the result will be whiter anterior teeth and darker posterior teeth, and many people show their molars when they smile. At-home bleaching using a custom tray reaches all teeth.

What about the efficacy of various light sources marketed for use with in-office bleaching? Here has been this author's challenge for several years to anyone who claims that a light increases in-office bleaching efficacy...publish a paper with proper scientific evidence showing that the light makes a difference. No one has done this. There are only two published papers on the use of lasers in bleaching, one showing that lasers are no more effective than other types of light, and one showing that lasers are less effective than 20 percent carbamide peroxide with no light. This author has published case reports showing one in-office treatment using a light-activated 35% hydrogen peroxide material did not achieve the results obtained from at-home bleaching with 10% carbamide peroxide. A light source will speed up an oxidation reaction, but whether this will speed up the color change of a tooth is not known. Someone needs to conduct a clinical double-blind, evidence-based study, possibly using a split-arch design, if they wish to prove that lights such as lasers or plasma arc are indeed efficacious for bleaching. It would be easy to do, but none of the manufacturers have done so thus far.

It should be noted that all of the lights used in in-office bleaching are "grandfathered" in terms of FDA marketing approval based on their equivalency to the original flood light used with the Union Broach in-office bleaching product. The Union Broach product, which originally used a flood light to generate heat, and the *Star Brite* product, which does not use a light source, are the only two 35 percent hydrogen peroxide in-office bleaching products that are approved by the American Dental Association. For at-home bleaching products, no product that contains higher than 10 percent concentration of carbamide peroxide is approved by the ADA, because all of the efficacy, safety and sensitivity studies have used 10 percent carbamide peroxide. While many at-home bleaching products contain a higher concentration of carbamide peroxide, and future literature may support their safety and efficacy, this author doesn't use any bleaching product that is not

ADA approved. Currently ADA-approved products include *Opalescence 10%* (Ultradent Products Inc.), *Platinum* and *Platinum Overnight* (Colgate Oral Pharmaceuticals), *Rembrandt Classic 10%* (DenMat), *NiteWhite Classic 10%* (Discus Dental), and *Patterson Toothwhitening Product*. The ADA-approval requires that any advertising claims have a scientific basis, and this is important because practitioners are being confused by a variety of marketing claims which are not supported by evidence.

### **Indications for Bleaching**

The clinical indications for bleaching teeth are basically the same for both in-office and at-home methods, but the clinician must decide which is the best method for a particular patient situation to achieve the desired result. There are many patients who are candidates for bleaching, including those whose teeth have been darkened by aging; people who were born with yellow teeth; people with stains from chromagenic foods such as tea and coffee; people with nicotine stains; those with drug-induced stains such as tetracycline; those with trauma-induced darkening; and people who have staining from fluorosis, which tends to produce brown and white areas.

Tetracycline staining, one of the significant challenges for bleaching, is most often associated with people who ingested the drug in their younger years, during tooth formation. However, there are several reports in the literature about adult teeth being stained by *minocycline*, which is the most commonly prescribed drug for acne. Teenagers who use this antibiotic may see their teeth change from white to a gray coloration by the time they graduate from college. *Minocycline* is laid down in the secondary dentin, and it is resecreted in the saliva and soaks into the outside of the tooth. *Minocycline* remains the best drug available for acne, so dentists should be aware that adults may present with this type of tetracycline staining.

### **Contraindications to Bleaching**

Contraindications to bleaching are mainly due to existing conditions of the patient. Existing crowns or extensive restorative dentistry where the restorations are tooth-colored, e.g., porcelains or composites, will not change color with bleaching. Bleaching will affect the natural teeth, but if replacing existing restorations in order to match the bleached teeth is a financial burden for the patient, this can be a

contraindication to bleaching. Patients with existing tooth sensitivity, or who experience sensitivity during bleaching to the degree that it is a real problem, represent a contraindication. While severe tetracycline staining is not necessarily a contraindication, these cases are difficult to bleach, especially the dark grays and blues and if the discoloration is located in the gingival third, which is the most difficult part of the tooth to bleach. Patients must be informed that the prognosis for such cases is guarded.

Elderly patients often present with gingival recession and roots that are yellow and evident to observers. The roots don't tend to whiten during bleaching, therefore the patient will be left with white teeth on the anatomical crown but yellow roots, so they must be aware of this. This could be a limitation to bleaching in this group. This author doesn't bleach teeth on pregnant women, although there is no scientific evidence that pregnancy is a contraindication. We simply do not want the woman to ever think bleaching caused a problem with her baby. If a woman discovers she is pregnant during bleaching, we ask her to stop for the same reason, and also because the bleaching solution could possibly exacerbate any pregnancy gingivitis problems she might have.

### **Tooth Sensitivity Due to Bleaching**

There are no studies comparing sensitivity between in-office and at-home bleaching. Many companies have no scientific basis for claims about the amount of sensitivity their products cause. A review of the double-blind, placebo clinical trials that have been done involving at-home bleaching will show that 55-75 percent of patients in the treatment group will experience some sensitivity, if only for one day. The interesting finding here is that the placebo groups have 30-35 percent sensitivity without using carbamide peroxide at all, and one study showed that a group wearing an empty tray had 18 percent with sensitivity. From these data one can assume that sensitivity is not just due to the bleaching product, it can also result from treatment manipulation of the teeth. Anything that places forces on the teeth has the potential to cause sensitivity.

The clinician can treat sensitivity either passively or actively. With at-home bleaching, passive treatment involves adjusting the frequency of treatment (every day, or skip a day, etc.) and duration of treatment (1-8 hours per day), and the concentration of carbamide peroxide. Often, simply stopping treatment for a

few days will alleviate sensitivity when treatment resumes. Actively, the traditional way to treat sensitivity was with fluoride or brushing with a desensitizing toothpaste. This author and colleagues have an abstract with the International Association for Dental Research this year (#3001) where we placed potassium nitrate and fluoride in a bleaching tray to treat bleaching sensitivity in the same manner as Jerome treated periodontal sensitivity. Just as hydrogen peroxide penetrates through the enamel and dentin and to the pulp, so does potassium nitrate. Fluoride acts primarily as a tubular blocker, plugging the holes and slowing down the fluid flow that causes the sensitivity. Potassium nitrate acts more like an analgesic or anesthetic by keeping the nerve from repolarizing after it has depolarized in the pain cycle. Therefore, there are two mechanisms of action, one affecting fluid flow and the other a direct effect on the nerve.

Several companies provide 3-5 percent potassium nitrate in a syringe for application in the bleaching tray as needed. Or, one can take a desensitizing toothpaste that contains 5 percent potassium nitrate, which is the maximum approved by the FDA, place it in the tray and apply it in this fashion for 10-30 minutes. Some patients may have a gingival reaction to the ingredients in the toothpaste, not to the potassium nitrate, and get a tissue burn, therefore the clinician may have to experiment with various formulations for certain patients. For patients with chronic sensitivity unrelated to bleaching, the toothpaste gives them an OTC product that they can use whenever they need it, even before a prophylaxis. The syringe materials that must be purchased from the companies may be more appropriate for episodic sensitivity associated with the bleaching itself. This author provides a free slide presentation on treating sensitivity on the internet at [www.dentalquest.org](http://www.dentalquest.org).

### **Types of Discoloration and Relative Bleaching Difficulty**

It is often easier to bleach the teeth of older patients because the pulp is small and they have accumulated a lot of stains that can be more easily bleached, including secondary dentin discoloration due to age. Aging discolorations and tea and coffee discolorations are very easy to bleach. Teenagers, too, may have yellow teeth, or yellow canines with white incisors. These cases also respond well to bleaching. Nicotine stains are more difficult to

bleach, and the single dark tooth presents a challenge, but is still amenable to external bleaching. Brown stains are also more difficult to bleach, and will require longer treatment time. Brown discolorations are responsive to bleaching perhaps 80 percent of the time. White spots, such as may occur in conjunction with brown spots in the case of fluorosis, will not change color but will become less noticeable as the rest of the tooth becomes lighter.

Mild and moderate tetracycline stains are responsive to bleaching if you give them enough time, but severe tetracycline stains are very difficult. Banded stains are a special challenge, and the clinician may have to use bonding to cover a particular band after bleaching. Tetracycline comes in about six different brands, and each brand causes a different color on the teeth. Banded teeth indicate that the patient took different brands of tetracyclines in a sequence, and each brand laid down a different color on the tooth. Some of those colors respond better to bleaching than others, and the ones that don't respond must be covered with bonding.

Remember the axiom, "bleach 'till they are white". Bleaching results depend on the individual patient's teeth and the type stain they have. You can't simply say that bleaching will take one day, or two weeks, or several weeks. It will take as long as it takes. Nicotine stains may take 1-to-3 months to successfully bleach, depending on how long the patient has been smoking. If you bleach for two weeks and don't get the response you seek, you might be tempted to say this doesn't work. In reality, it is likely that the treatment time was inadequate.

### **The Evolution of Bleaching**

We are starting to better understand the different bleaching vehicles or bases, e.g., glycerin, anhydrous glycerin, several different kinds of glycols, toothpaste bases, etc. We are seeing more sophistication in this area. We are also learning that the way in which the material releases oxygen may affect sensitivity. We know that roughly 50 percent of the peroxide in a bleaching agent is released in the first 1-2 hours, and the rest is released over the next 4-6 hours. This is why advocates of overnight at-home bleaching believe you get the best "bang for the buck" with this technique, with the least amount of sensitivity and most bleaching efficacy in a single application per day. However, some products release the peroxide more rapidly, and this can have an effect on sensitivity. The future

evolution of the science of bleaching will likely involve further development of the vehicles and the release time of the peroxide.

Bleaching is just starting to catch on in Europe, and this may contribute to enhancements that we in this country haven't considered.

### **The Importance of Dentist Supervision**

There are advertisements for at-home bleaching products that one can order directly from a company, with no dentist involvement. The most important thing the dentist offers patients is the initial exam and diagnosis, which cannot be done without the patient coming to the dental office. So many times people will come to the dentist to have their teeth bleached, and the dentist finds that they need endodontic therapy, which is why the tooth is dark. Or they have internal resorption and need aggressive treatment, or class 3 decay that is dark and needs treatment, or restorations that are dark and need replacing due to secondary caries. Proper examination and diagnosis, including radiographs, are needed to rule out pathology that will require completely different treatment from bleaching.

The second service dentists offer is a custom fitted tray. You can have a loss of efficacy of the bleaching material if it is not properly contained in the tray, and you have an increased risk of TMJ problems or occlusal problems, or even orthodontic movement of the teeth, with an ill-fitting tray. Dentists can also ensure quality of product by using an ADA approved product, and by knowing the shelf life of the product. Some products bought over the counter or by mail order may not have good quality standards, may have a low pH, or may have a short shelf life. The dentist can monitor any side effects and take immediate action to address them. And, the dentist can take before-and-after photographs, which will demonstrate changes in color and properly document pre-existing conditions in the teeth, such as

notching, that patients could incorrectly blame on the bleaching itself if pre-operative photographs were not taken.

One problem dentistry may create for itself is charging too much for bleaching in an attempt to make a lot of money on a few patients. The national average in 1999 for bleaching was \$196 per arch, and this is very reasonable and fair to both patient and dentist. As noted previously, for tetracycline stained teeth that will require longer term treatment a monthly fee can be fairly established.

### **Conclusion**

Bleaching offers an excellent solution to many cases of tooth discoloration, and in this author's opinion at-home bleaching offers many advantages when compared to in-office technique. No matter whether at-home or in-office methods are selected by the clinician and patient, both parties must understand that each case is different. If the clinician uses in-office bleaching, the patient should be given the choice of at-home or in-office bleaching after explaining the fees, treatment times, and number of appointments for successful outcomes. The time required to achieve desired results will vary, and the patient's expectations in this regard must not be unrealistic. The key is to "bleach 'till they are white". Don't give up too early and switch to veneers or another less conservative treatment until bleaching has been given a fair chance.

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