

Overpower Frustrating Whitening Cases: A Tetracycline Stain Case Study

by Dr. Kevin Potocsky

Frustration with teeth whitening systems is a frequent topic discussed between dentists. In my practice, we have tried many whitening systems, both in-office and take-home. All have been inconsistent with many disappointing results.

Intrinsic coloration/staining of teeth is due to stain or pigment molecules within the enamel and dentin. The larger these molecules are, the darker they are. With time, pigment and stain molecules within tooth structure join together forming larger and larger, darker and darker molecular complexes. Add to this the extrinsic stains that absorb into tooth structure, becoming intrinsic, and the color of teeth continues to darken with time. To make matters worse, over time, pigment, stain and other micro-debris compress into the microstructure of teeth, and even between individual enamel rods, preventing easy access by peroxide whitening by-products.

Whether you start with hydrogen peroxide or carbamide peroxide, the active ingredient is hydrogen peroxide (H_2O_2). Hydrogen peroxide breaks down to several combinations of hydrogen and oxygen, including oxygen ions and free radicals (Fig. 1).

The whitening process takes place in two ways: 1) Like “scrubbing bubbles,” oxygenation breaks up densely packed micro-debris within tooth structure and removes it via diffusion, and 2) free radicals attack the large, long-chain dark pigment and stain molecules, converting them to thousands of tiny particles, which are colorless and white (Fig 2).

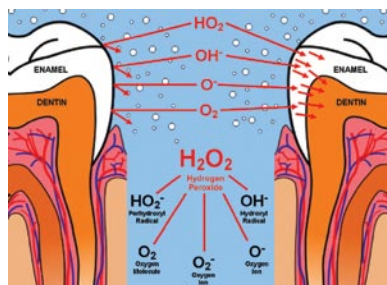


Figure 1: Breakdown of hydrogen peroxide into various combinations of hydrogen and oxygen bleaching factors. The level of permeability of the teeth to these bleaching factors determines the predictability of whitening

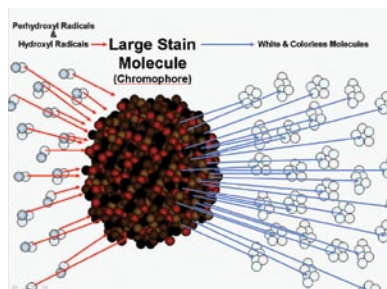


Figure 2: Large, dark long-chain pigment and stain molecules are broken down by free radicals from hydrogen peroxide, resulting in thousands of small colorless and white particles.

Young Teeth vs. Old Teeth

Any dentist who has whitened the teeth of a young person age 14 or 15 will tell you that the teeth whitened to an extreme degree, and did so very quickly. Conversely, a dentist who has attempted whitening of a patient age 80 will tell you of the extreme difficulty achieving any whitening. Teeth continuously become more densely packed with micro-debris and more difficult to whiten with age. In addition to age, there is also variability from individual to individual.

Permeability of tooth structure to bleaching factors (oxygen, oxygen ions and radicals) determines the amount of whitening success. If bleaching factors can get into tooth structure and flood stain molecules, those dark stain molecules will be removed or converted from large dark molecules to tiny colorless and white particles. Varying levels of permeability is the answer to the frequent question of why teeth whitening is so frustrating and unpredictable.

Oxygenation, the first step in whitening, is capable of removing tightly packed stain debris, thus improving permeability to bleaching factors to reach deeper and deeper stain molecules. However this takes continuous oxygenation over time. In-office use of high concentration hydrogen peroxide in contact with teeth for only 30-40 minutes is not nearly enough time to restore permeability. If the bleaching factors released by high concentration peroxide are unable to enter the tooth structure, very little whitening will occur.

It is common knowledge within dentistry that conventional at-home whitening trays allow only 25-35 minutes of continuous oxygenation and release of bleaching factors. The reason for the short activity time is leakage of bleaching gels from bleaching trays, and destruction of bleaching gels due to continuous contamination by saliva and sulcular fluid. This is one reason the most difficult region of teeth to whiten is the cervical. The cervical is the first area of contamination and inactivation of bleaching gel by saliva and sulcular fluid.

Some have recommended that bleaching trays cover the marginal gingiva, which may reduce saliva contamination; however this specifically directs the constant secretion of sulcular fluid into the cervical region of the bleaching gel, quickly inactivating the gel.

Limitations of conventional at-home whitening are due to the lower concentration of peroxide and the very short duration of activity.

The answer to these frustrations in our practice has been a whitening system developed by Dr. Rod Kurthy, referred to as the KöR Whitening Deep Bleaching™ System (Evolve Dental Technologies, Inc.), consisting of a very specific technique and products with precise physical properties designed for the technique.

The basis of the technique is an in-office visit to initiate “conditioning” of tooth structure (removal of densely-packed micro-debris, enhancing permeability to bleaching factors) with a highly accelerated 9% hydrogen peroxide. Due to the intense 1:1 ratio of peroxide to accelerator, the result is release of bleaching factors far exceeding the amount expected from a 9% hydrogen peroxide. Given the 9% concentration, retractors and paint-on dam are not necessary, and gel is simply applied in the KöR Deep Bleaching Trays.



Figure 3: KöR Deep Bleaching Trays – Most patients wake up forgetting the KöR Trays are in their mouths, with gel still within the trays. KöR Trays create a seal in the cervical 1 - 1.25mm of the teeth, sealing gel in and sealing damaging saliva/sulcular fluids out. This, with the KöR Whitening gels results in 6+ continuous hours of whitening instead of the typical 25-35 minutes.

The first in-office visit is followed by fourteen consecutive nights of at-home whitening, utilizing the detailed KöR Deep Bleaching Trays, which are not only extremely comfortable for the patient, but seal the bleaching gel in, and seal out saliva and sulcular fluids (Fig. 3).

Most at-home bleaching gels are made ultra-viscous and insoluble in saliva. This is necessary because even well-fitting conventional bleaching trays are not

capable of a cervical seal. The high viscosity and insolubility help keep bleaching gel inside the trays, however high viscosity and insolubility also inhibit release of bleaching factors from the gels.

Because of the effective cervical seal of KöR Deep Bleaching Trays, KöR Whitening gels were formulated with a lower viscosity and higher saliva solubility, promoting more thorough release of bleaching factors from the gel, exposing the tooth to higher concentrations of these factors.

Because of the cervical tray seal, loss of gel and ingress of saliva and sulcular fluid are greatly reduced, allowing oxygenation and release of bleaching factors in excess of six full hours instead of only the typical 25-35 minutes. Some activity has even been found for up to ten hours.

The 14 consecutive nights of extended release of bleaching factors continuously breaks down and removes stain and debris, rejuvenating and restoring the youthful permeability of the teeth. This enhanced permeability results in flooding the deeper large dark stain molecules with bleaching factors, thoroughly converting them to small white and colorless particles

The final in-office visit employs an accelerated, high concentration (27%) hydrogen peroxide. At this time the tooth is fully permeable to the high concentration of bleaching factors liberated. Any stain molecules resistant to the at-home 16% carbamide peroxide (equivalent to 5% hydrogen peroxide) are now rapidly broken down by the high concentration gel.

The result has been exceptional success of all of our whitening cases, with extremely excited patients and dental staff. However our question was if KöR Whitening Deep Bleaching would have success on our patient with severe tetracycline stains.

Like fluorosis, tetracycline stains are more inorganic in nature, given that they actually bind strongly to and become part of tooth structure itself. They are not simply stain molecules to break down.

The patient, a female in her late 40s with severe tetracycline staining, desired color improvement of her teeth, and improvement of the shape of her upper anterior teeth. She presented with existing PFM crowns on teeth numbers 8 and 9, with a Vita shade of C-3, however you can see that her natural tetracycline-stained teeth were darker than a C-4 shade, with the darkest being the cervical thirds (Fig. 4).



Figure 4: Before – Shade C-3 PFM crowns on teeth #8 & 9. Tetracycline stained natural teeth are darker than C-4. Note how much darker teeth are than crowns.



Figure 5: After – Tetracycline stained natural teeth have whitened lighter than shade B-1. Note that teeth are now much lighter than crowns. Approximately 25-shade change.

The Tetracycline Stain Protocol of the KöR Whitening Deep Bleaching System calls for four to six weeks of at-home whitening instead of the standard two weeks. In the case presented, just four weeks of at-home whitening was accomplished, followed by the final in-office application of the chemically accelerated KöR 27% hydrogen peroxide.

The patient’s teeth whitened extremely well, reaching a shade significantly lighter than the Vita B-1 shade. The PFM crowns of teeth numbers 8 and 9 were replaced with Empress® (Ivoclar Vivadent Inc.) jackets, and the remaining upper anterior teeth were veneered also using Empress porcelain.

The patient’s reaction to the transformation of a lifetime of tetracycline stained teeth to a beautiful, white smile was overwhelming. At post-op visits, she continued to say that she now “just can’t stop smiling!”

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Given the ability of KōR Deep Bleaching to rejuvenate tooth structure to its original youthful ability to absorb bleaching factors, and the ability to virtually flood the microstructure of the teeth with bleaching factors, even the very difficult fluorosis and tetracycline stain patients can be treated with great success in a short time.

Even patients with otherwise normally discolored teeth desire truly white teeth

We have found that patients often show concern before whitening, asking if their teeth might become too white. These are typically patients who have seen others with stark white, opaque veneers or jackets, thinking they were whitened teeth. However, after using previous whitening systems on these same patients, they often asked if we could get their teeth even whiter, and many have been disappointed with the results.

To date, every patient we have whitened using the KōR Deep Bleaching System has been extremely excited with the result. An unexpected benefit of the system turned out to be the low level, and usually total lack of sensitivity. The oxygenation process of any bleaching system, though beneficial to whitening, is one of the causes of bleaching sensitivity. Any type of peroxide whitening technique (even over-the-counter products) will result in oxygenation removing smear plugs from dentinal tubules, resulting in typical bleaching sensitivity.

Most recommend potassium nitrate, in one form or another, to treat this sensitivity. However potassium nitrate does not plug dentinal tubules. It simply diffuses slowly into the pulp, reducing the ability of neurons to re-polarize. For some, discomfort can be subdued partially, however this simply treats the symptoms and not the pulpal inflammation. ACP is also sometimes suggested, however ACP has primarily been developed for and investigated regarding its affect on enamel, not dentin. The suggestion that ACP may actually create tooth structure growth within the dentinal tubules, lowering sensitivity has not been borne out in studies. Even if this were the case, the process is not rapid.

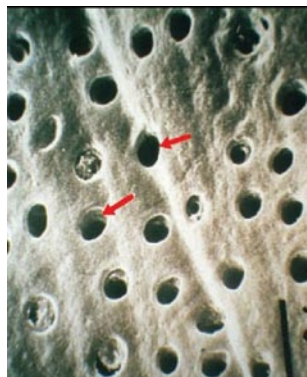


Figure 6:
Open dentinal tubules –
tubule orifices have been
opened, allowing typical
bleaching sensitivity.



Figure 7:
Dentinal tubules have been
thoroughly closed/plugged by
Evolve® KōR Hi-White Desensitizer,
preventing bleaching
sensitivity.

The approach utilized by the KōR System is active plugging of the dentinal tubules with two different desensitizers (Figs 6 & 7). One in-office desensitizer is an inorganic oxalate desensitizer, and the other, used both in-office and daily by the patient at home, is a HEMA/fluoride based desensitizer.

By keeping the dentinal tubules plugged, bleaching sensitivity is prevented instead of simply treating the resultant symptoms. In our practice we have found extremely low, and usually no reports of sensitivity from our patients.

This new system has caused significant change in my practice. The biggest concern of dentists is the care of our patients, but we also realize that, like it or not, our dental practice is a business, with the same needs as other businesses. We have noticed a considerable increase in referrals because of the KōR Whitening Deep Bleaching System. Others readily notice the beautiful, natural whiteness of our patients' teeth, often followed by compliments to our patients. Our patients typically then hand out our business card.

This is no coincidence. When we perform the final Deep Bleaching visit for our patients, and when we see their extreme excitement when looking in the mirror, this provides the perfect opportunity to hand them a few business cards, asking them to let others know about us. And with their excitement and appreciation, they always respond very favorably to this suggestion. It seems that every Deep Bleaching patient of ours frequently receives compliments, and most are anxious to provide our cards to others when they receive those compliments.

Another thing we have found is the competition between family members, including spouses. The whitening achieved with Deep Bleaching is so profound that typically the "other" spouse feels uncomfortable smiling next to the spouse with such white teeth. Sooner or later, we typically see the other spouse for KōR Deep Bleaching.

When our patients' teeth become so white, they are excited and proud. They start looking at their own teeth much more intently, sometimes noticing irregularities that they had never noticed, or possibly never had concern about previously. Because of this, we have found renewed interest and excitement regarding other cosmetic dentistry, including orthodontics, gingival re-contouring, porcelain veneers, etc.

My staff no longer has apprehension suggesting whitening to our patients. They now have complete confidence that ALL of our whitening patients will be delighted.

Dr. Potocsky is a 2001 graduate of the University of Detroit Mercy School of Dentistry. He has maintained a private practice focusing on cosmetics, implants, orthodontics and family dentistry in Allen Park, Michigan since 2001. He may be contacted at (313) 381-1633.

Disclosure: Dr. Kevin Potocsky has no financial or other interest in any company mentioned in this article and received no compensation for writing this article.