New Science in the World of Whitening

Hygiene duo outlines how whitening education leads to increased treatment, patient satisfaction
How often do we hear, “I know I have cavities … but how do I get my teeth whiter?” We all cringe over that question, but over the years the smile has found a niche in the beauty industry. Whitening is the most commonly requested dental procedure, with $1.4 billion in sales per year; it’s been proven to be the fastest way to enhance the beauty of the smile. Patients are interested in having brighter, younger-looking smiles, and are purchasing the whitening products to do so.

Professionally administered whitening products, which have the supervision of the dentist and their hygiene team, are always in the best interest of patients’ oral health and beauty. Patients who are concerned with the color and beauty of their smiles are better dental patients, who tend to seek additional treatments and are more conscious of their oral health. In addition, creating a strong whitening program within the dental office provides a natural platform to discuss tooth shade with your patients, and facilitates a financial gain to your hygiene or ancillary production. Integrating whitening into a sequenced oral care plan allows for a comprehensive approach to aesthetic dental cases.

With so many options and delivery systems available, how can the dental professional determine which is the best whitening system—one that ensures the best results with minimal tooth sensitivity? Here’s what you need to know when choosing a whitening system for your practice.

The science of whitening

What makes up tooth color? Three factors that affect tooth shade are genetics, environmental factors (e.g., medication and nutritional habits) and the patient’s ability to maintain a healthy mouth.

The enamel is the most highly mineralized substance of the tooth, consisting of calcium phosphate and packed hydroxyapatite. Because the enamel is semitranslucent, its color may vary from yellowish to grayish, but it’s only partially responsible for the color of the teeth.

Enamel rods are arranged in rows perpendicular to the secondary layer of the tooth, the dentin. The color in dentin comes from color molecules known as chromophores. These chromophores contain double bonds that can absorb visible light rays that contribute to the darkened or stained appearance of teeth. Hydrogen peroxide breaks down into water and peroxide ions. These peroxide ions then bind to the chromophores, which breaks the double bond. The single-bonded chromophores absorb less light (reflecting light), resulting in whiter teeth.

We are also aware of the role of intrinsic and extrinsic staining in tooth shade. Intrinsic stains lie within the dentin surface and are more difficult to remove. Intrinsic stains may be caused by medications, fluoride exposure, and environmental factors such as genetic or systemic conditions. Extrinsic stains are surface stains that attach to the biofilm and enter the enamel matrix. This type of staining is typically derived from a patient’s habits, such as smoking or coffee consumption, over a period of time.
Whitening benefits

As dental providers, we have an incredible opportunity to gift our patients with a simple treatment that offers a youthful, beautiful and healthy smile. Whitening is a higher-level cosmetic procedure that can be easily incorporated into any oral health care appointment. Patients who have brighter smiles are more motivated to maintain healthy smiles. Offering whitening generates revenue to a practice while establishing an emotional component to your dental care that combines beauty and health.

Contributing factors

**Contact time.** When dental professionals think about the value of time, practice chair time and patient treatment time quickly come to mind. When selecting a modern whitening system, adequate contact (treatment) time is an essential element to achieving the desired shade change; however, prolonged contact time is a contributing factor to patient sensitivity and may lengthen the patient visit.

How can we effectively whiten without long appointments or treatment sensitivity? Modern whitening systems with heat-activated mouthpiece technology are one preferred option. The heat activation increases efficacy while decreasing treatment time, thereby preventing sensitivity. A closed-system mouthpiece mimics a peripheral seal, trapping the whitening oxygen ions onto the leading edge of the enamel surface. When combined with the accelerating power of heat activation, the closed system maximizes the efficacy of whitening applications, producing fast, dramatic improvements in tooth shade without sensitivity.

Studies show that pulp damage occurs when temperatures exceed 53 degrees Celsius. When selecting a heat-activated whitening system, look for technology that uses a temperature below this threshold to prevent treatment sensitivity.

**Concentration of hydrogen peroxide.** The higher the percentage of concentration of hydrogen peroxide, the more dramatic the results. However, at high concentrations, there is a risk of sensitivity. Hydrogen peroxide concentration for chairside whitening typically runs from 24 to 38 percent, which is why placing a protective cheek retractor and gingival barrier is necessary. The hydrogen peroxide content in at-home bleaching products usually ranges from 3 to 10 percent, but some home-use products have contained up to 15 percent.

**Level of pH.** The health benefits of an alkaline pH (7 or higher) are talked about in regard to food, oral care products, supplements, water, pools and more. But what’s pH got to do with whitening gel? An acidic oral pH (less than 5.7) is associated with tooth erosion, enamel demineralization, acid reflux, GERD and tooth sensitivity. Foods and drinks with an acidic pH—colas are pH 3.5—should be consumed sparingly to prevent secondary effects on systemic and oral health.

Generally, the pH within the mouth ranges from 6.2 to 7; enamel demineralization occurs when the pH level falls below 5.7. Therefore, it’s important to be aware of the pH of the foods and drinks your patients are consuming. In addition, it’s important to consider...
the pH of the whitening gel when choosing the right whitening system for your patient's enamel health and sensitivity.

Choosing a whitening gel that falls into the basic (alkaline) category will help prevent enamel demineralization and tooth sensitivity. An alkaline pH environment also optimizes the hydrogen peroxide whitening gel and its oxidation effect; an alkaline environment produces a 50 percent greater whitening result in the same amount of time as a lower pH environment.

**Open versus closed environments.** Bleaching can occur via two methods of delivery: an open-system environment or a closed-system environment.
- An *open-system environment* occurs during chairside whitening and is completed using a heat lamp outside of the mouth. The lamp's high temperature compensates for the hydrogen peroxide that escapes into the atmosphere. In *closed-system environments*, such as bleaching trays or mouthpieces, the seal keeps the active ingredient in hydrogen peroxide concentrated, which results in superior whitening results.

It's important to be mindful that the main differences between take-home and chairside whitening are contact time and the concentration of hydrogen peroxide gel. Understand that each patient's teeth lighten differently and that some require a combination of both in-office and take-home whitening to achieve their smile goal.

**Temperature.** Hydrogen peroxide has innate oxidizing and antiseptic effects, exemplified by at-home whitening systems that remove tooth stain. However, this process has a long wear time and should be recommended for qualified patients and patients who have a darker baseline shade. Adding heat via modern whitening delivery systems decreases exposure time and increases efficacy. LED light and heat mouthpieces can be found in many modern whitening systems; however, heat is the true catalyst. LED light has not been shown to have a significant effect on whitening results. When the temperature is increased (within a safe range), the reaction rate accelerates, leading to a quicker, more efficient whitening session.

**Why does whitening cause tooth dehydration and sensitivity?**

We often hear of whitening procedures that dehydrate teeth, resulting in teeth that look whiter initially but darken just a few days later once the teeth rehydrate. Dehydration is a common side effect of almost all chairside teeth bleaching treatments that use a light.

During chairside whitening, light enters the tooth at a high intensity and has the effect of dissipating the bleach through the tooth. The light energy is absorbed by the dark areas of the teeth, dentin and pulp. These areas warm up, causing the fluids in the tooth to expand. The fluids are subsequently forced out of the tooth through the dental tubules, causing dehydration and sensitivity during the procedure.

Throughout the chairside whitening procedure, a gingival barrier and cheek/lip retractor are placed to prevent the highly concentrated hydrogen peroxide from burning or traumatizing...
the soft tissue. The same technique is used to protect areas of recession and attrition where the dentin is exposed, and there is a risk for extreme sensitivity.

Providing a closed system bleaching alternative with controlled heat inhibits hydrogen peroxide from escaping into the atmosphere and reduces the risk of pulpitis. This type of delivery system allows tooth rehydration during the whitening procedure, which reduces the chances of the “rebound effect” described above. It’s important to review manufacturer recommendations of the products you offer and to convey important information about the procedure to your patient. Doing so minimizes miscommunication and unrealistic patient expectations.

**Assessment and maintenance**

Tooth shade assessment and management by the dentist and hygienist are essential tools for every professional whitening program. The program is designed to facilitate conversation about tooth color with patients via an organic platform and engage them in the assessment process.

As our bodies mature, teeth darken with age. On average, teeth darken 2–3 shades every 10 years because of diet and thinning enamel, which reveals more-yellow colored dentin that can make teeth appear darker. It’s important to note that tooth whitening has a cumulative effect of breaking down stains over time; essentially, the more someone whitens, the more quickly the teeth will respond and the lighter they’ll become because of more and more contact time with whitening ingredients. Therefore, it behooves the dental team to discuss whitening and dental treatment options individualized for each patient based on his or her age, sensitivity level and previous history of whitening. Regular
whitening maintenance is essential to stabilize and prolong tooth shade. Compared with other beauty regimens that require multiple visits for touch-ups, professional whitening maintenance can be discussed at recall visits, as well as hygiene appointments with the dentist.

**Whitening gels: Hydrogen peroxide versus carbamide peroxide**

Understanding how whitening gel works to break up tooth stains is an important part of selecting the best whitening system, and can be a valuable tool when educating your patients. As stated earlier, double-carbon bonds are responsible for the yellow color in tooth stains. The whitening molecules absorb into the semipermeable membrane of the tooth and break double carbon bonds into single-carbon bonds.

Many professional whitening gel formulas are formulated with hydrogen peroxide or carbamide peroxide. How can we determine the most effective formula for patients? Which formula produces the fewest byproducts and least tooth sensitivity?

Hydrogen peroxide breaks down into water and oxygen ions, or whitening molecules.6 The whitening oxygen ions effectively target double-carbon bonds, and when heat is added the reaction rate doubles to accelerate the whitening applications.

When selecting a hydrogen peroxide formula, look for a stable hydrogen peroxide system with a hermetically sealed delivery system. In modern whitening systems, a pH raiser is typically added to hydrogen peroxide formulas to increase shelf life and efficacy.

Carbamide peroxide breaks down into hydrogen peroxide, urea and ammonia.5 Because of its formula structure, carbamide peroxide has one-third the whitening power of hydrogen peroxide. The lower efficacy of carbamide peroxide lengthens treatment time, which can cause tooth and gum sensitivity.

**How to communicate with patients about whitening**

The word *selling* is taboo in the dental world, and most dentists and hygienists are uncomfortable bringing up the topic of whitening. *Educating* is a word we feel confident using. Comparable to X-rays and perio chart assessments, shade assessment is a tool that allows us to monitor the health and vitality of patients’ teeth over a period of time. Further, it motivates patients to share their thoughts about whitening comfortably, and educates them about how their lifestyle may be affecting their tooth shade.

Having open conversations with patients about expectations and reality is crucial. When treatment planning, asking patients to identify their ideal tooth shade is just as important as assessing their starting shade. We know not all patients’ teeth whiten the same, so it’s best to speak candidly about patient expectations to help create a personalized bleaching treatment.

Depending on the starting shade, a treatment plan may be developed that involves both in-office and professional take-home applications. Teeth that are yellow in shade typically have better results than teeth that have a grayish hue. Take before-and-after photos to show progress and results, and if regressions occur; this will prompt patients to stay motivated to maintain ideal tooth shade. By explaining the science and methods behind whitening to your patient, your discussion is no longer perceived as selling but as educating.

A key component to integrating a successful whitening business into your practice is a team effort. Discussing whitening promotions during morning huddles or monthly meetings is a great way to promote consistency and cohesiveness among your team.

**Before and after photos**

Figs. 1 and 2: A 24-year-old smoker presented with C2 shade, whitened to a B1 with in-office Glo Science Professional whitening 30 percent H2O2 gels. He reported no sensitivity.

Figs. 3 and 4: A 32-year-old presented with A3 shade whitened to an 1M1 with the
in-office Glo Science gels; her take-home regimen involved five days in a row, with four 8-minute applications per day. Reported no sensitivity.

**Figs. 5 and 6:** Patient did four 8-minute passes of Glo Science Professional whitening gels in-office; take-home regimen included 14 days of treatments, with four 8-minute applications per day. Result: Patient moved 16 shades on the Vita shade scale, starting at C4 and ending at 1M1.

**Conclusion**

Tooth whitening is in high demand, and consumers turn to over-the-counter whitening products because of their popularity and accessibility. However, professionally administered whitening is always best. The overall benefits of integrating a whitening program into a professional dental practice are overwhelming; every patient of yours is a whitening patient, and every whitening patient is a whitening-maintenance patient. Offer your patients the best whitening experience by choosing a system that requires little chair time and utilizes heat activation technology to amplify the hydrogen peroxide gel in a closed-system mouthpiece.

With high-quality whitening treatments utilizing the latest advances in dental technology, you and your patients will have plenty of reasons to smile.

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**References**


