Considerations for Managing Bleaching Sensitivity

Tooth sensitivity is the single most significant deterrent to bleaching, and must be understood to be able to manage the treatment of patients. All forms of vital tooth bleaching are associated with some level of sensitivity. Therefore, the dental office and the patient must be prepared for the possibility of sensitivity during bleaching treatment.

PREVALENCE AND CAUSE

The three major classes of bleaching—in-office, tray, and over-the-counter (OTC)—all demonstrate some prevalence of sensitivity. Typical bleaching ingredients are either hydrogen peroxide or carbamide peroxide. For comparison, a 10% carbamide peroxide product is approximately 3.5% hydrogen peroxide. Generally, the higher the concentration of the peroxide, the greater the chance of sensitivity. In-office bleaching uses the highest concentration of peroxide (15% to 35% hydrogen peroxide), and has a range of sensitivity from 10% to 90%, with some sensitivity being so severe as to require analgesics posttreatment. Typically, multiple in-office visits are required for maximum whitening, and those visits should be spaced at least 1 week apart to allow for reduction of sensitivity caused by treatment. It is also recommended to pre-medicate patients with non-steroid anti-inflammatory drugs to reduce the incidence of sensitivity.

The second highest concentration of peroxide is found in the OTC products. These products typically range from 6% to 15% hydrogen peroxide. Although they have a shorter treatment time due to the limited efficacy of hydrogen peroxide (30 to 60 minutes), they still generate tooth sensitivity as well as gingival irritation. Even shorter treatment times of OTC strips with higher concentrations have exhibited greater sensitivity than lower concentrations with longer treatment times.

The classic tray bleaching treatment involves 10% carbamide peroxide or 3.5% hydrogen peroxide. Incidences of 25% to 75% are reported, although differences in study design influence data in all treatment options. Generally, sensitivity occurs in the first 2 weeks of treatment, often in the first few days. The more recent addition of potassium nitrate to bleaching materials has reduced, but not eliminated, sensitivity. It is important to note that the presence of sensitivity is the most probable cause for persons discontinuing bleaching, with one report of 14% termination of bleaching due to sensitivity.

A recent report on double-blinded, placebo-controlled clinical trials has provided evidence that the addition of low levels of potassium nitrate and/or potassium nitrate and fluoride significantly reduce postoperative sensitivity relative to products that do not contain either agent.

Whereas all of the typical causes of dentin hypersensitivity generally involve the hydrodynamic theory of fluid flow, the sensitivity associated with bleaching seems to have a different origin. In bleaching situations, the teeth may be in excellent condition, with no cracks, exposed dentin, or deep restorations, but after a few days of bleaching, the tooth may experience severe sensitivity. This seems to be related to the easy passage of hydrogen peroxide.
Patient History of sensitivity or positive exam (touch or air) →

Bleaching Sensitivity Treatment: Stage 1 Prevention

Initial prophylaxis 2 wks prior to bleaching
Accurate alignate or PVS impression for tray →

Patient has no history of sensitivity or sensitivity findings

Patient brushes with desensitizing toothpaste containing potassium nitrate and fluoride for 2 weeks

Review oral hygiene brushing technique and recommend soft/extra soft toothbrush

Evaluate diet to remove acidic beverages and fruits or wines

One arch, soft tray is delivered & evaluated for tooth fit, gingival irritation and ease of removal

Patient wears empty tray for 1-2 nights

Patient wears tray with desensitizing toothpaste for 1-2 nights

If gingival irritation from toothpaste, locate non-SLS toothpaste or professional product

Patient continues to brush with desensitizing toothpaste, but brushes 30 minutes prior to tray insertion, and waits 30 minutes after bleaching to brush

Patient begins bleaching with low concentration of carbamide peroxide product containing potassium nitrate and fluoride, ideally overnight or 2-4 hrs daily

Proceed to stage 2 chart for treatment of sensitivity during bleaching

**Figure 2** Bleaching Sensitivity Treatment: Stage 1 Prevention options in patients with existing sensitive teeth.
and urea through the intact enamel, through the dentin in
the interstitial spaces into the pulp within 5 to 15 minutes.18
In effect, the tooth is a semipermeable membrane that is
quite open to certain-sized molecules. Once it is understood
how easily the peroxide penetrates the tooth, the resultant
pulpal response of sensitivity may be considered a reversible
pulpitis. Tooth sensitivity is the main side effect of bleach-
ing, and may be caused primarily by the peroxide penetra-
tion to the pulp, and secondarily by the mechanical pressure
of an improperly fitting tray or occlusion on the tray. The
other side effect recorded is gingival irritation, which may
be related to an improperly fitted tray, occlusion on the tray,
or chemical irritation from higher concentrations of hydro-
gen or carbamide peroxide.

PREVENTION

Because tooth sensitivity mainly depends on inherent patient
sensitivity, frequency of application, and concentration of
the material, a history of sensitivity should be determined
during the examination.14,19 Patients generally will report
or should be asked if their teeth are sensitive to cold. Ad-
ditionally, existing sensitivity can be determined from the
preoperative exam by simple methods of explorer contact
with areas on the teeth, or air blown on the teeth. Patients
can be counseled in the frequency of application and the
appropriate concentration of bleaching agent, with instruc-
tions that applications more than once a day or higher con-
centrations of bleaching agent increase the likelihood of
sensitivity.3,4,20-22 All other delineators, such as pulp size,
exposed dentin, cracks, gingival recession, caries, sex or age
of the patient, or other physical characteristics are not pre-
dictive of who would have sensitivity.

Most reports of sensitivity occur within the first 2 weeks,
regardless of how long the patient may treat their teeth.
Often, these reports are a single day of sensitivity, followed
by no problems the next day. The tooth’s response to bleach-
ing is very individualistic, and can only be determined by
beginning treatment. However, the history of sensitive teeth
by the patient, as well as their response during examination
to explorer touch or air, can be a reasonable predictor.

Because bleaching tends to produce some tooth sensitiv-
ity under ordinary circumstances, patients with pre-existing
tooth sensitivity must be cautioned that increased sensitivi-
ty, albeit transitory, may occur, and that management of the
sensitivity may require a longer time span for bleaching as a
result of the additional time to treat the sensitivity.

Other contributors to sensitivity include rigid tray mate-
rials, the base vehicle composition and viscosity, flavoring
agents, or patient habits such as clenching or bruxism. The
short-term pulpal response varies from patient to patient
and even from tooth to tooth. Although penetration of per-
oxide through the tooth to the pulp can produce sensitivity,
the pulp remains healthy and the sensitivity is completely
reversible when treatment is terminated. No long-term
sequelae remain after the sensitivity has abated.23-25 Research
also has shown that patients have tooth sensitivity even
when using a non-bleaching agent in a tray, or just wearing
a tray alone. Hence, it is not possible to have all patients be
sensitivity-free because of the mechanical forces of materials
and occlusion, and some plans must be made to address
potential problems.

TREATMENT

RECOMMENDATIONS

Most of the earlier treatments for sensitivity involved tray
bleaching, as the ease of use of this system and universal
popularity made it the most commonly used system for
tooth bleaching.26,27 The passive approach for treating sen-
sitivity was first used. This involved a reduction in wear
time, or in frequency of application. Sensitivity treatment
could also involve temporary interruption of the bleaching
treatment. After the interruption, treatment can often be

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and/or potassium nitrate and fluoride significantly reduce postoperative
sensitivity relative to products that do not contain either agent.
Bleaching Sensitivity Treatment: Stage 2 Treatment

Patient begins bleaching and encounters sensitivity:
Consider Passive or Active treatment options

Passive Treatment options

Reduce concentration of bleaching material if possible

Patient reduces wear time at day or night

Patient changes from night wear to day wear

Patient skips a night or day of bleaching

Patient stops bleaching for an extended period of time

Patient proceeds to active treatment options

Active Treatment options

Continue or initiate brushing with desensitizing toothpaste

Place desensitizing toothpaste into tray and wear for 10-30 minutes before or after bleaching, or whenever discomfort

If gingival irritation occurs with toothpaste in tray, obtain non-SLS containing toothpaste.

If gingival irritation occurs with non-SLS toothpaste in tray, obtain professionally supplied potassium nitrate product

Wear tray with potassium nitrate product in place of bleaching material overnight for 1-2 nights

Switch patient from one brand of bleaching material to another, or from one type (hydrogen peroxide or carbamide peroxide) to another

If patient is unable to manage bleaching sensitivity, the bleaching is terminated and other restorative options are considered

Figure 3 Bleaching Sensitivity Treatment: Stage 2 Treatment options for patients who experience sensitive teeth during bleaching.
resumed without any further sensitivity. Cessation of treatment results in no lingering sensitivity. Although the passive approach has some success, patients and dentists prefer to have a more active approach. The active approach involves the use of either fluoride, potassium nitrate, or both in combination. Traditionally, fluoride has been used as a method of reducing sensitivity. The primary mechanism for action is to occlude dentinal tubules or increase the hardness of enamel, which impedes the flow of materials to the pulp. However, the peroxide molecule is so small that it can travel in the interstitial spaces between the dentinal tubules. Hence, fluoride has not been particularly beneficial in treating bleaching sensitivity.

**Potassium Nitrate Use in Bleaching**

Potassium nitrate has a completely different mechanism of action than fluoride. Potassium nitrate penetrates the enamel and dentin to travel to the pulp and creates a calming effect on the nerve by affecting the transmission of nerve impulses. After the nerve depolarizes in the pain stimulus-response, it cannot re-polarize, so the excitability of the nerve is reduced. Potassium nitrate almost has an “anesthetic-like effect” on the nerve.

One study demonstrated that applying potassium nitrate for 10 to 30 minutes in a bleaching tray could be successful in reducing sensitivity in more than 90% of the patients, and allow them to complete the bleaching procedure successfully.28 This technique was originally used by Jerome to treat tooth sensitivity after periodontal surgery in non-bleaching patients.29 He placed desensitizing toothpaste into soft trays that covered the now-exposed root surfaces of the teeth, and achieved good results. For patients with chronic sensitivity unrelated to bleaching, the toothpaste gives them an OTC product that they can use whenever they need it with tray application, even before a prophylaxis. This approach was extended by Haywood to include patients experiencing sensitivity during bleaching.28 Tray application could be used either before or after the bleaching treatment (Figure 1). Because the pain can occur remotely from the bleaching treatment, the potassium nitrate could be used as needed during the day or night. In severe situations, the potassium nitrate could be substituted for the bleaching material on alternating nights of wear.

The more readily available source of 5% potassium nitrate in the United States is desensitizing toothpastes that contain 5% potassium nitrate. Five percent is the maximum amount of potassium nitrate approved by the US Food and Drug Administration, and is the primary ingredient for sensitivity treatment allowed in OTC toothpaste. Based on the tray application study, desensitizing toothpaste can be placed in the tray for 10 to 30 minutes whenever sensitivity occurs. The only caution with toothpaste application is that some patients may experience a gingival reaction to the foaming ingredient sodium lauryl sulfate. This reaction is not caused by the potassium nitrate. The reaction generally produces a tissue burn or reddening of the gingiva. If this irritation occurs with one brand or flavor of toothpaste, the clinician may have to experiment with various OTC formulations for certain patients. Initially there was only one toothpaste available which had potassium nitrate, but not sodium lauryl sulfate, and that was the original “Pink packaged” Sensodyne. More recently, the advent of “Pronamel Sensodyne” has provided a new option for a non-sodium lauryl sulfate, potassium-nitrate containing toothpaste to be used in brushing or in the tray for treatment of sensitivity.

If suitable toothpaste cannot be found for the patient, then the clinician should use the professionally available products containing 3% to 5% potassium nitrate and fluoride.
Several companies provide 3% to 5% potassium nitrate in a syringe for application in the bleaching tray as needed. The syringe materials, which must be purchased from the companies, may be more appropriate for episodic sensitivity associated with the bleaching itself where the toothpaste was not acceptable because of the gingival response. There are also disposable trays containing potassium nitrate which may be helpful, especially if there is no bleaching tray available for in-office techniques being used alone.

Once research determined that potassium nitrate in the tray was successful, the next step was to incorporate this material in the bleaching material rather than require a separate application. First attempts were not too chemically successful, but now most manufacturers have their bleaching product containing both fluoride and potassium nitrate. Examples of this would be Opalescence PF (Ultradent Products, Inc, South Jordan, UT), NiteWhite™ Excel and NiteWhite™ ACP (Discus Dental, Culver City, CA), Contrastm™ (Spectrum Dental, Corpus Christi, TX), GC TiON™ (GC America), and Opalescence™ Treswhite™ Supreme (Ultradent Products). Early concerns were that either the fluoride or the potassium nitrate would interfere with the bleaching, but one study has indicated that bleaching efficacy is not reduced.30 Certainly, if there is any reduction in efficacy or increase in time of treatment, it is minor, and much better than termination of bleaching resulting from unmanageable sensitivity.31 Having the potassium nitrate in the material could also minimize the effects of mechanical irritation from an improperly fitting tray or occlusion causing movement of the tray and resultant tooth sensitivity.5

**Pre-Brushing with Potassium Nitrate for Sensitivity Avoidance**

Even though tray application of potassium nitrate was very effective, and the incorporation of potassium nitrate into the bleaching material has helped, these advances do not totally eliminate sensitivity. Relief from sensitivity requires brushing with potassium nitrate for approximately 2 weeks to be effective.32 A recent study33 compared patients who pre-brushed with the toothpaste containing potassium nitrate (Sensodyne) for 2 weeks before initiating bleaching to another group that used conventional fluoride-containing toothpaste. The group that pre-brushed with the potassium nitrate-containing toothpaste had less sensitivity overall, less sensitivity in the first 3 days, and more sensitivity-free days before a first occurrence. Results of patient surveys showed that the switch to a potassium nitrate-containing toothpaste was easy and well-accepted.

**Recommended Treatment**

Bleaching sensitivity may result from a combination of the patient’s pre-existing tooth and gingival conditions, the chemical nature of the peroxide, and the mechanical nature of the tray. The dentist should determine if the patient has pre-existing sensitive teeth that require a protocol to minimize sensitivity during bleaching. If the patient has no pre-existing sensitivity, a proactive protocol should be developed to address sensitivity should it occur. Figure 2 and Figure 3 offer this information in two treatment options, one for patients with a history of sensitivity, and one for patients with no pre-existing sensitivity. They also explain the options for passive or active treatment of sensitivity that occurs once the bleaching process is initiated.

**CONCLUSION**

Treatment of bleaching sensitivity involves many possible options (Figure 4). Prebrushing with a potassium nitrate-containing toothpaste can reduce or avoid sensitivity from bleaching. Tray application of potassium nitrate can be an effective episodic treatment for sensitivity. Other treatment time variations, use of different concentrations of material, and varying tray designs can all be part of a sensitivity management program. It is far better to try to avoid or minimize the sensitivity with the above steps than to treat sensitivity after it occurs. Even with all these options for sensitivity avoidance and treatment, there are still some patients who cannot manage their sensitivity and elect to terminate bleaching. Sensitivity seems to be a multi-factorial event which cannot be entirely controlled in every patient. However, the majority of patients, after a proper dental examination, history, and radiographs, can find an appropriate method with adjustment of treatment time and material, brushing with a desensitizing toothpaste containing potassium nitrate, or tray application of potassium nitrate, to minimize any sensitivity they may encounter, and proceed to a successful completion of the bleaching process.

**REFERENCES**