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.[1-6] Hence, 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.[7] 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.[8-10] Typically, multiple in-office visits are required for maximum whitening,[11] and those visits should be spaced at least 1 week apart to allow for reduction of sensitivity caused by treatment.[12] It is also recommended to pre-medicate patients with non-steroid anti-inflammatory drugs to reduce the incidence of sensitivity.[12] 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.[13]

The classic tray bleaching treatment involves 10% carbamide peroxide or 3.5% hydrogen peroxide. Incidences of 25% to 75% are reported,[14,15] 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.[16] 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.[17]

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.[3,5]

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

Figure 1 Tray application of a potassium nitrate-containing desensitizing material is a very effective approach to treatment of sensitivity.

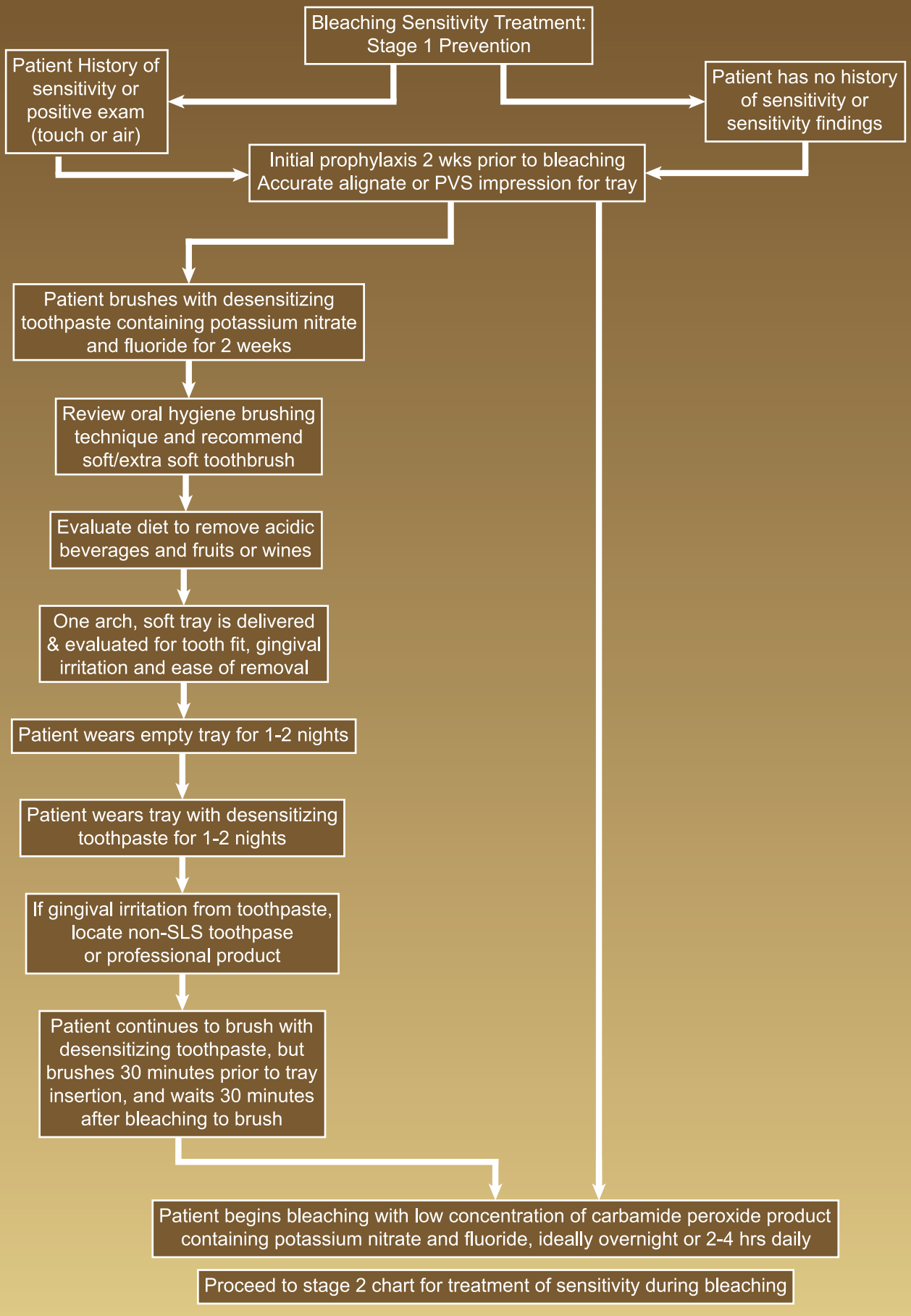

Figure 2 Bleaching Sensitivity Treatment: Stage 1 Prevention options in patients with existing sensitive teeth.

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 bleaching, and may be caused primarily by the peroxide penetration 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 hydrogen 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. Additionally, 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 instructions that applications more than once a day or higher concentrations 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 predictive 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 bleaching 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 sensitivity under ordinary circumstances, patients with pre-existing tooth sensitivity must be cautioned that increased sensitivity, 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 materials, 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 peroxide 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 sensitivity 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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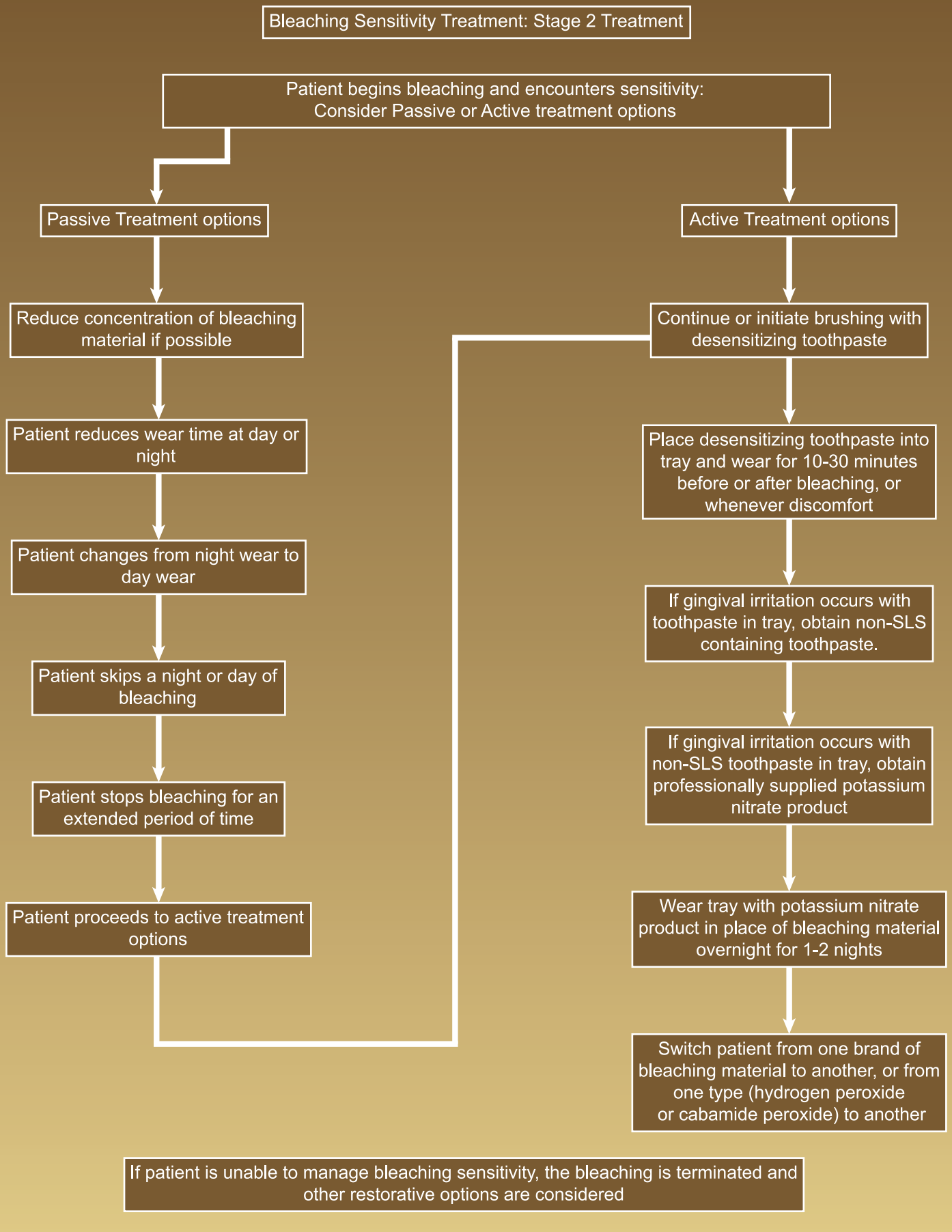

Figure 3 Bleaching Sensitivity Treatment: Stage 2 Treatment options for patients who experience sensitive teeth during bleaching.

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.

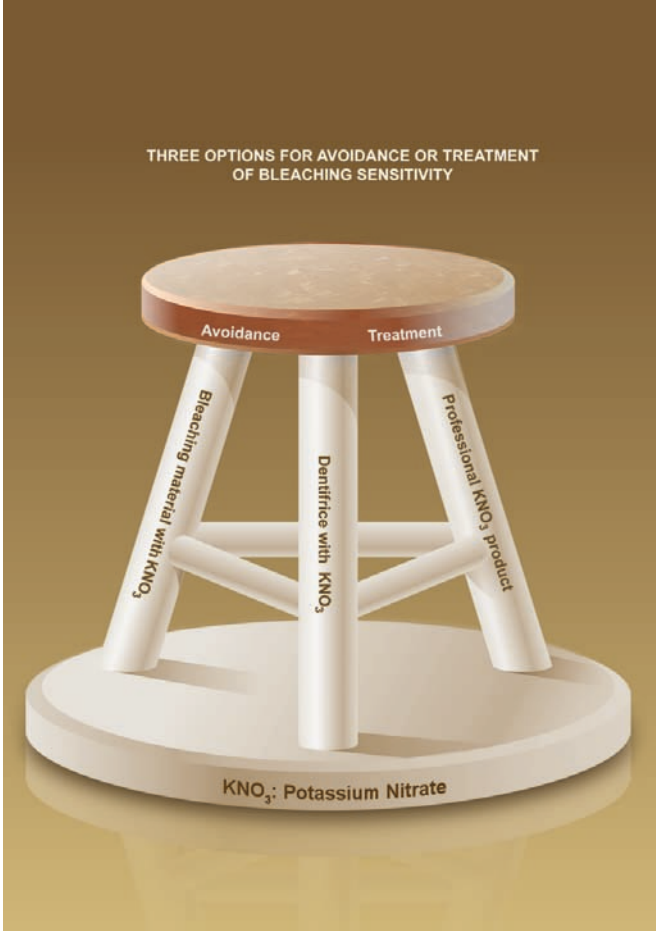

Figure 4 The three options for avoidance or treatment of bleaching sensitivity involve the application of potassium nitrate products either in the bleaching tray or topically.

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 laural 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 laural 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), Contrastpm® (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 study[33] 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.

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