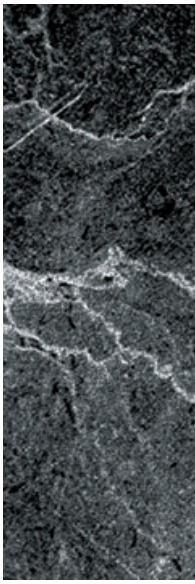

Critical Appraisal

AT-HOME BLEACHING: PULPAL EFFECTS AND TOOTH SENSITIVITY ISSUES, PART II

Author and Associate Editor

Edward J. Swift Jr, DMD, MS*

The most common side effect of at-home bleaching is transient tooth sensitivity. Despite its high frequency, this phenomenon is not well understood. This is the second of a two-part Critical Appraisal on tooth sensitivity associated with at-home bleaching. The first installment reviewed articles that focus on the incidence of sensitivity, long-term effects of bleaching, and related pulpal concerns. This installment also covers pulpal concerns, as well as the prevention of sensitivity during at-home whitening treatments.

THE DENTAL PULP: INFLAMMATORY MARKERS AND VITAL BLEACHING

O.J. Fugaro, J.O. Fugaro, B. Matis, R.L. Gregory, M.A. Cochran, and I. Mjör
American Journal of Dentistry 2005 (18:229–32)

ABSTRACT

Objective: This study evaluated the effects of an ADA-accepted night-guard vital bleaching regimen on levels of two specific neuropeptides within the human dental pulp.

Materials and Methods: Ten subjects, ranging in age from 12 to 28 years and requiring premolar extractions for orthodontic reasons, were enrolled in the study. The teeth were free of caries and restorations, and had normal periodontal health. Custom bleaching trays were made on study models cast from alginate impressions. The trays were modified so that bleaching agents could be applied only to the selected teeth.

The bleaching agent used was a 10% carbamide peroxide gel (Opalescence, Ultradent Products, South Jordan, UT, USA), which was applied nightly for at least 6 hours. The bleaching regimen was

**Professor and chair, Department of Operative Dentistry, University of North Carolina, Chapel Hill, NC, USA*

arranged so that the final treatments were no treatment for the control tooth #28, 4 days for #5, 2 weeks for #12, and 2 weeks of bleach application followed by 2 weeks without treatment for #21.

After extraction, the teeth were immediately frozen in liquid nitrogen, and were kept frozen until they were prepared for evaluation. The pulp tissue was removed and was submitted to an enzymatic assay process to determine levels of total protein, substance-P (SP), and calcitonin gene-related peptide (CGRP). SP and CGRP are neuropeptides that act as modulators of pain and inflammatory responses within the pulp.

Results: Levels of SP and CGRP in the three experimental groups were not significantly different from those in the control group.

Conclusions: Bleaching with 10% carbamide peroxide caused no increase in pulpal neuropeptides in young patients with relatively permeable teeth, suggesting that bleaching does not cause pulpal inflammation or injury.

COMMENTARY

Because tooth sensitivity is not an uncommon side effect of at-home bleaching, some clinicians and researchers have speculated that bleaching may cause some type of inflammatory response in the pulp. This study evaluated pulpal levels of two neuropeptides that are involved in certain aspects of the body's inflammatory response. If bleaching caused pulpal inflammation, one would expect to find increased levels of both neuropeptides in the pulp tissue. However, this study clearly showed no such increase.

The obvious clinical implication is that short-term at-home bleaching with a 10% carbamide peroxide gel is safe for the pulp. The authors were careful to point out that different results might be obtained with higher concentrations of peroxide. Extended bleaching regimens might also have different effects.

SUGGESTED READING

Fugaro JO, Nordahl I, Fugaro OJ, et al. Pulp reaction to vital bleaching. Oper Dent 2004;29:363–8.

Norevall LI, Forsgren S, Matsson L. Expression of neuropeptides (CGRP, substance P) during and after orthodontic tooth movement in the rat. Eur J Orthod 1995;17:311–25.

EFFECT OF POTASSIUM NITRATE AND FLUORIDE ON CARBAMIDE PEROXIDE BLEACHING

L. Tam

Quintessence International 2001 (32:766–70)

ABSTRACT

Objective: The purpose of this double-blind clinical trial was to evaluate the effect on tooth sensitivity when potassium nitrate and fluoride were added to a 10% carbamide peroxide bleaching gel.

Materials and Methods: In a group of subjects ranging in age from 20 to 53 years (average 31), 21 dental arches were bleached. Custom trays were fabricated, and the subjects were instructed to apply a bleaching gel overnight for 14 consecutive nights. The bleaching gels were a control 10% carbamide peroxide product, and the same material containing 3% potassium nitrate and 1,100 ppm fluoride.

Each subject applied both gels—the experimental material on one side of the arch and the control material on the other side of the arch. The products were packaged identically, and the assignment of materials to either the left or right side was done randomly.

Pre- and post-treatment photos of the teeth were made, and shades were evaluated against a standard shade guide. Subjects recorded their perceptions of tooth sensitivity in

daily log forms. For each side of the arch, they recorded sensitivity along a 100-mm visual analog scale ranging from "no sensitivity" to "extreme sensitivity." They also were able to choose from a list of descriptors (such as "rare," "frequent," "elicited by cold," etc.) to further characterize their sensitivity.

Results: The average daily treatment time was 7 hours. One subject discontinued treatment after 9 days because of tooth sensitivity on the control side. Tooth sensitivity generally increased over the course of treatment in both groups.

Overall, the addition of potassium nitrate and fluoride significantly decreased tooth sensitivity. The statistical analysis showed a significant reduction in tooth sensitivity (versus the control) on days 3, 9, 10, 11, and 13. Sensitivity associated with the experimental gel was never greater than with the control. All sensitivity ceased after treatment.

The bleaching result was similar for both products.

Conclusions: The addition of potassium nitrate and fluoride to a 10% carbamide peroxide bleaching gel resulted in significantly less tooth sensitivity over a 2-week at-home bleaching regimen, without detracting from the bleaching result.

COMMENTARY

Potassium nitrate and fluoride are both common topical treatments for tooth sensitivity. This study demonstrated that these agents can be added to carbamide peroxide bleaching gel to substantially reduce tooth sensitivity during treatment without decreasing effectiveness. More recently, other agents, such as amorphous calcium phosphate, have been added to bleaching gels to reduce sensitivity.

SUGGESTED READING

Pohjola RM, Browning WD, Hackman ST, et al. Sensitivity and tooth whitening agents. J Esthet Restor Dent 2002;14:83–91.

Gerlach RW, Zhou X, McClanahan SF. Comparative response of whitening strips to a low peroxide and potassium nitrate bleaching gel. Am J Dent 2002;15:19A–23A.

Browning WD, Chan DCN, Frazier KB, et al. Safety and efficacy of a nightguard bleaching agent containing sodium fluoride and potassium nitrate. Quintessence Int 2004;35:693–8.

Giniger M, MacDonald J, Ziemba S, Felix H. The clinical performance of professionally dispensed bleaching gel with added amorphous calcium phosphate. J Am Dent Assoc 2005;136:385–92.

BRUSHING WITH A POTASSIUM NITRATE DENTIFRICE TO REDUCE BLEACHING SENSITIVITY

V.B. Haywood, R. Cordero, K. Wright, L. Gendreau, R. Rupp, M. Kotler, S. Littlejohn, J. Fabyanski, and S. Smith
Journal of Clinical Dentistry 2005 (16:17–22)

ABSTRACT

Objective: This study was designed to compare tooth sensitivity associated with at-home bleaching between two groups of subjects: one using a potassium nitrate desensitizing dentifrice twice daily versus another using a standard fluoride dentifrice.

Materials and Methods: The study was conducted by a clinical research organization in 14 dental offices in Florida. A total of 202 patients completed all aspects of the study.

All patients used the same bleaching regimen—a 14-day treatment using Day White Excel 3 (Discus Dental, Culver City, CA, USA), a product that contains 9.5% hydrogen peroxide. (This concentration is equivalent to 33% carbamide peroxide.)

Patients were randomly assigned to one of the two groups. The control group used a standard fluoride dentifrice. The experimental group used a dentifrice containing 5% potassium nitrate in addition to fluoride (Sensodyne Fresh Mint, GlaxoSmithKline Consumer Healthcare, L.P. Moon Township, PA, USA). The potassium nitrate dentifrice was used twice daily for 2 weeks before treatment, and

continued during the 2-week treatment period.

Subject diaries were used to record compliance and the occurrence of tooth and gingival sensitivity. Sensitivity was self-reported daily along a 100-mm visual analog scale (VAS) ranging from "no sensitivity" to "extreme sensitivity." The subjects also were asked to rank the degree of sensitivity along a 1- to 5-scale ranging from "extremely bothersome" to "not at all bothersome." After completion of treatment, subjects were contacted by telephone to obtain information about their satisfaction with sensitivity issues and willingness to repeat the bleaching procedure.

Shade changes of the upper right central incisor were evaluated in comparison with a value-oriented Vita shade guide (Vita Zahnfabrik, Bad Säckingen, Germany).

Results: Shade changes were similar in both groups, at about four shade guide units. Overall, the intensity of tooth sensitivity was low, as measured by both the VAS scale and the "bothersomeness" rankings. As measured by the VAS scale, the potassium nitrate dentifrice did not provide a statistically significant reduction in sensitivity versus the control. However, significantly fewer subjects in the experimental group developed sensitivity during the first week of bleaching and had significantly more sensitivity-free days during treatment. Significantly, more subjects in the experimental group were satisfied with their treatment experience and were more willing to repeat the procedure.

Conclusions: Use of a potassium nitrate dentifrice before and during an at-home bleaching regimen could be a useful adjunct for managing the tooth sensitivity that frequently occurs.

COMMENTARY

Pain and sensitivity have strong subjective components, and therefore are very difficult to quantify precisely in a clinical trial. This particular study attempted to reduce subjectivity by enrolling a rather large group of subjects.

Desensitizing agents such as fluoride and potassium nitrate have been added to some bleaching gels as a means of reducing tooth sensitivity. This study demonstrates that the use of an adjunct product, a potassium nitrate dentifrice, can also help reduce tooth sensitivity. Patients who used the potassium nitrate dentifrice had a delayed onset of sensitivity, more sensitivity-free days, and a greater willingness to repeat the bleaching procedure.

It should be noted that desensitizing dentifrices are effective only if used in a regular regimen. Patients cannot expect good results when using these only sporadically.

SUGGESTED READING

Haywood VB, Caughman WF, Frazier KB, Myers ML. Tray delivery of potassium nitrate-fluoride to reduce bleaching sensitivity. Quintessence Int 2001;32:105–9.

Leonard RH, Smith LR, Garland GE, Caplan DJ. Desensitizing efficacy during whitening in an at-risk population. J Esthet Restor Dent 2004;16:49–56.

Swift EJ. Tooth sensitivity and whitening. Compendium 2005;Suppl 3:4–10.

Haywood VB. Treating sensitivity during tooth whitening. Compendium 2005;Suppl 3:11–20.

THE BOTTOM LINE

Tooth sensitivity is the most common side effect associated with at-home bleaching. About 50% of patients are likely to experience at least mild sensitivity sometime during the bleaching treatment. The best predictor of sensitivity is a history of sensitivity.

Fortunately, any sensitivity that does occur is very transient, and ceases either shortly after completion of treatment or even during treatment. Clinical studies have shown no long-term pulpal effects, and histological studies of recently treated teeth have reported no significant pulpal problems.

The incidence and severity of tooth sensitivity can be reduced by the use of desensitizing agents such as potassium nitrate either in the bleaching product itself or in adjunctive products.

Editor's Note: We welcome readers' suggestions for topics and contributors to Critical Appraisal. Please address your suggestions to the section editor:

Critical Appraisal—Dr. Edward J. Swift Jr.
Department of Operative Dentistry
University of North Carolina
CB#7450, Brauer Hall
Chapel Hill, NC 27599-7450
Telephone: 919-966-2773; Fax: 919-966-5660
Email: Ed_Swift@dentistry.unc.edu