Science-Based Solutions to Whitening Sensitivity

Solutions to teeth whitening sensitivity include the following:

1. Creation of whitening gels with the lowest osmolality possible, to reduce the osmotic gradient between whitening gel and dentinal tubular fluid, thereby reducing intratubular fluid flow and sensitivity.\(^{16,17,33,34,63,66,80,81,91-93}\)

   a. Whitening gels should not only be aqueous,\(^{16}\) but 100 percent aqueous (lowest possible osmolality\(^{17,80,91-93}\)). To extend shelf life and aqueous gel stability during storage, constant refrigeration must be used instead of the use of anhydrous gels\(^{3,8,14-16,30,32}\) (anhydrous gels have much stronger osmolality). By utilizing constant refrigeration to lengthen shelf life, instead of using the mentioned chemical stabilizing, not only are the whitening gels more unstable (more effective\(^{14-17}\)) when placed in the warm mouth, but the osmolality can be as little as 1/11th that of gels that are chemically stabilized.\(^{17,80,91-93}\) That means 11 times less pull on the dentinal tubular fluid, and therefore significantly less sensitivity.


* Visit www.dentaltown.com/rodkurthy to view the three previous articles.

In the last three articles* you’ve learned about the science of teeth whitening, why problems occur and about how to overcome obstacles to whitening. In this fourth and final article of this series, Dr. Kurthy will discuss how the science of whitening sensitivity can be utilized to reduce the incidence of whitening sensitivity and the steps he has taken to utilize this science.
2. Prevention of dental hypersensitivity during whitening with rapid, aggressive occlusion of dentinal tubules, before and after each whitening activity instead of treating symptoms after they occur. Part III of this series discussed commonly used desensitizers that take time to either enter the pulp or plug the dentinal tubule orifice. With whitening sensitivity, we need desensitizing to work now! We need instantly effective desensitizing products and protocols. Reinforcement of tubular smear plugs immediately prior to whitening, and rapid, aggressive replacement of any smear plugs lost during the oxygenation phase of whitening immediately after each whitening session results in predictably less sensitivity.

3. Prevention of zinger-type sensitivity with rapid, aggressive occlusion of enamel and dentin aberrations before and after each whitening activity. According to the hypothesis of zinger etiology presented in Part III of this series, prevention of molecular hydrogen peroxide into the pulp would prevent whitening zingers.

4. Use of desensitizer before and/or after whitening, but not mixed in with the whitening gel itself. Remember the discussion in the previous article (Part III) regarding how the aggressive oxygenation during whitening will interfere with the formation of tubular plugs during whitening, and how the tubular flow during whitening is outward from the pulp, making it more difficult for desensitizers to “swim upstream” into the pulp.

5. Avoidance of bleaching lights or lasers. Numerous studies have proven the ineffectiveness of bleaching lights and lasers. With the ability to predictably accelerate whitening gels via pH and chemical acceleration, there is no need to consider the use of potentially harmful bleaching lights or lasers.

KöR Whitening Sensitivity Solutions

KöR Whitening has utilized the listed solutions to whitening sensitivity based on the known science previously discussed.

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Fig. 1: Hydrogen Peroxide (H2O2) is the active end product of all peroxide whitening systems. H2O2, depending on the whitening gel storage temperature, whitening tray environment and whitening gel chemistry, may break down to ineffective oxygen and water, or it may break down to effective bleaching factors including free radicals. When radicals are produced, hydrogen ions (acid) are also produced.

KöR Whitening Sensitivity Solutions

1) Reducing the “Pull” on Dental Tubular Fluid

KöR Whitening is the first teeth whitening company to refrigerate a full line of whitening gels from the instant of manufacture until dental offices receive the whitening gels cold. By using refrigeration as the stabilizer of the product instead of chemical stabilizers, not only is the shelf life even longer, but the whitening gel is even more unstable (more effective14-17) when placed in the warm mouth and has as little as 1/11th the osmolality of products.

The much lower osmolality greatly reduces the “pull” on dentinal tubular fluid, reducing whitening sensitivity.17,66,81,91-95

2) Keeping Dental Tubules Closed

The science shows that rapid profound closure of dental tubules, immediately before and after whitening procedures, results in the most predictable whitening sensitivity control possible.73,77

KöR utilizes desensitizers that instantly plug dentinal tubules (Figs. 2 and 3).66,126,127,129-134 The primary KöR Desensitizer is a HEMA- (hydroxyethyl methacrylate) based desensitizer. HEMA is a hydrophilic dentin bonding derivative – a resin primer. HEMA-based desensitizers bind with proteins within dentinal tubules to form organic plugs within the tubules.66,126-128 The result is immediate and profound.

HEMA-based desensitizers have a long history of successful, immediate desensitizing via occlusion of dentinal tubules and are well supported by years of research.126,127,129-134 HEMA-based desensitizers provide rapid, aggressive plugging and replugging of tubules, with no reduction in whitening effectiveness whatsoever (Figs. 4 and 5).

To understand the importance of this desensitizing protocol, remember that the oxygenation phase of any type or brand of peroxide whitening will dislodge natural and synthetic tubular smear plugs, resulting in open dentinal tubules.123,124 This is one of the reasons that whitening sensitivity is common. This increases the hydraulic conductance (discussed in Part III of this a series) by 32-fold, greatly increasing whitening sensitivity.87,89

To reduce the loss of smear plugs during whitening, it is important to “supercharge” the smear plugs prior to whitening; and realizing that some smear plugs will be lost during whitening, it is important to replug these tubules immediately after.

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3) Closing Tooth Structure Aberrations that Allow Peroxide to Enter the Pulp

Many agree that split-arch clinical testing is the most accurate for whitening studies,135-138 as well as sensitivity studies. With split-arch studies, one process and/or product is used on one side of the patient’s arch, and another (often the control) is used on the opposite side of the same patient’s arch. After the testing process, it is very simple to see any difference in the sides, and to ask the patient regarding sensitivity felt. When numerous patients are tested this way, the results are very accurate and convincing.

Our split-arch studies of the KöR Desensitizer showed a 90 percent decrease of not only type 1 generalized whitening sensitivity, but also a 90 percent decrease in type 2 zinger-type whitening sensitivity. Given the hypothesis of zinger-type 2 whitening sensitivity etiology presented in Part III of this article series,125 it may be assumed that the KöR Desensitizer, in addition to plugging open dentinal tubules, may also plug aberrations in tooth structure that would otherwise allow molecular hydrogen peroxide access to the pulp. At this point you may have the same question and concern that I originally had, wondering if this same KöR Desensitizer, with its “plugging” capability, may actually impair the effectiveness of whitening.

To objectively answer this concern, we performed numerous split-arch clinical cases. Patients were treated with both in-office and at-home whitening. Both types of whitening were accomplished on both sides of the patients’ arches, however, prior to and immediately after whitening, KöR Desensitizer was applied to only one side of the patients’ arches. In every case, the whitening results appeared exactly the same on both sides of these patients’ arches, confirming that the KöR Desensitizer caused no reduction in whitening effectiveness whatsoever (Figs. 4 and 5).

4) No Need for a Bleaching Light or Laser

As discussed previously, not only are bleaching lights and lasers commonly recognized as being of no benefit for whitening,48,55-60 but studies have shown a significant increase in whitening sensitivity and sometimes acute pain.16,17,49,112

By separating in-office whitening gels into three separate containers (Tri-Barrel) instead of only two containers (Dual Barrel), KöR in-office Dual Activated, Tri-Barrel Hydremide Peroxide (Fig. 6) was...
formulated with two distinctly different chemical accelerators, both of which force a rapid breakdown of peroxide to the most effective bleaching factors.

This allows not only very effective whitening, but prevents the formation of substance P within the pulp, greatly reducing the potential of discomfort from in-office whitening.139

5) Preventing the Formation of Acidic pH During Whitening

As discussed previously, the breakdown of peroxide to the most effective whitening factors also results in the release of large numbers of hydrogen ions (acid) (Fig. 1).10,12,13,26-30 With the ability to separate the whitening formula into three separate containers (Tri-Barcode), KÖR has been able to add a buffering system to its whitening gels (Fig. 6). The result is the ability to force the most effective bleaching factors from peroxide, yet neutralize the acid as it forms.

This ability keeps the osmolality of the whitening gel very low,10,12,13,26-30 (less potential for sensitivity10,12,13,26-30) as well as avoiding the acid removal of smear plugs during whitening and other detrimental changes to tooth structure.13,26

As you may remember, acid is also a chemical stabilizer of whitening gels,10,12,13,26-30 so by preventing the acid buildup during whitening, the chemical remains very unstable, and therefore very effective throughout the entire time of application.13

KÖR Desensitizer also contains sodium fluoride. Sodium fluoride not only may enhance the desensitizing effect,13,26,13,26 but most importantly, has been shown to promote remineralization and increased enamel surface micro-hardness after whitening.139,140 Remineralization may promote the filling of natural surface voids in enamel opened by the oxygenation (cleaning) phase of whitening,139 which may not only increase enamel surface micro-hardness,139,140 but result in an even whiter result and less potential for relapse of whitening.

There is currently no effective whitening system that can truthfully claim “no sensitivity,” however, with the meticulous scientific approach discussed in this article series, both the incidence and severity of whitening-related sensitivity may be greatly reduced, and in the majority of cases virtually eliminated.

Conclusion

In this four-part article series discussing the science of teeth whitening, you have learned the science of how teeth whitening works, why teeth whitening failures and sensitivity occur, and the effective solutions to predictably achieve the maximum whiteness possible for all of your patients.

You’ve also learned that predictable and impressive teeth whitening is not simply about slapping some whitening gel on the teeth. There is far more to it than that. The effective solution is not difficult – it’s not costly – it is simply precise, detail-oriented and based on scientific principles.

To receive more information about the KÖR Whitening System, call (866) 763-7753.

Author’s Bio

Dr. Rod Kurthy practices in Mission Viejo, California. He graduated with highest honors from Fairleigh Dickinson University School of Dentistry in 1978, and completed a GP residency at Newark Beth Israel Medical Center.

Dr. Kurthy’s 35 years of research and development include laser and surgical periodontal bone regeneration; endodontic surgery, including bone regeneration and repair of resorptive lesions; teeth whitening; teeth sensitivity; and development of several cosmetic techniques and impression techniques, to name a few. His first participation in periodontal research was in 1976, and teeth whitening in 1977.

He is an international lecturer and author of five popular clinical and dental marketing books. He is the recipient of awards and accolades including the Mosby Scholarship Award; FDU Prosthodontics and Pediatric Dentistry Awards; the Omicron Kappa Upsilon Gold Key Award; a commendation from the Chief Attorney of the United States Department of Defense for his role in supporting patients’ rights in disputes with insurance carriers; and in March, 2005, he was selected as the most respected member of Dentaltown.com by more than 60,000 of his peers.