# Evaluation of the sustainability of Different Desensitizing Agents after in-Office Bleaching

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**Abstract:** Objective: The purpose of present study is to compare the effect of different desensitizing agents in the management of dentinal hypersensitivity after the application of in-office bleaching. Methods: This study was conducted on 27 patients complaining of tooth hypersensitivity and seeking for their teeth whitening. Gluma, Seal & Protect and Fluoride varnish desensitizing agents were used in this study then in-office bleaching was applied. The Verbal Rating Scale (VRS) was used to record scores before and after desensitization, and then was used again to record scores before and after in-office bleaching. The data compiled was statistically analyzed. Results: A remarkable reduction in dentinal hypersensitivity to both air blast and cold water stimuli was noted at the end of the application of the three desensitizing agents. However, the differences in effectiveness of the desensitizing effect after the application of the bleaching material were recorded. Conclusion: Within the limits of this study, it could be implied that for relieving hypersensitivity, all three desensitizing agents were almost equally effective, but it was concluded that the sustainability of the desensitizing effect was detected with the resin-based desensitizing agents rather than the Fluoride-based desensitizing agents.
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## 1. Introduction:

Dentinal hypersensitivity (DH) is characterized by short sharp pain arising from exposed dentine in response to stimuli typically thermal, evaporative, tactile, osmotic or chemical and which cannot be ascribed to any other form of dental defect or pathology [(1)].

The difficulty found in treating DH is expressed by the enormous number of techniques and therapeutic alternatives to relieve it. Several methods and materials, such as varnishes, liners, restorative materials, dentinal adhesives, dentifrices and mouthwashes are used to reduce dental sensitivity [(2).] During the past several years, patients have become increasingly interested in the esthetic benefits available from dental treatment. In Periodontics, esthetic outcomes can be enhanced with crown lengthening, edentulous ridge augmentation or root coverage by means of a variety of surgical techniques [(3,4).] Restorative procedures that modify the shape, position or shade of teeth are used widely to accomplish esthetic goals [(5).]. Non-restorative procedures such as enamel microabrasion [(6)] and tooth bleaching [(7)] are popular alternatives to restorative treatment when the goal is to achieve a lighter shade of enamel. Internal bleaching of endodontically treated teeth is done to reverse the darkening that frequently occurs in conjunction with pulpal necrosis. Bleaching of vital teeth has been performed in the dental office from many years [(8,9,10,).]

A variety of products have been reported to successfully reduce dentinal hyper-sensitivity. These products generally occlude and seal the dentinal tubules. Resin-based materials have been reported to successfully reduce dentinal hypersensitivity [(11,12).] Thus, the purpose of this study was to investigate the clinical efficacy of some desensitizing agents to sustain its desensitizing effect after in-office bleaching.

## 2. Methodology:

This study was conducted on 27 patients specially complaining from teeth hypersensitivity and seeking for teeth whitening. Signed informed consent were obtained from all patients who participated in this study. The selected examined teeth were incisor, canine and premolar for every patient. Each tooth was isolated by cotton rolls and operator's fingers and subjected to air blast and cold water tests as follows:
Air blast test: The nozzle tip of an air syringe was kept about 1- 2 cm away from the isolated tooth and then a blast of air was directed on the tooth for one second. Cold water test: A disposable syringe was filled with ice-cold water and the water was applied on the suspected isolated tooth surface drop by drop. Therefore, VRS (Verbal Rating Scale) was used to record scores:-

0 – Was recorded for those patients with No discomfort
1 – Was recorded for patients complaining from Mild discomfort

2 – Was recorded for patients complaining from Moderate discomfort
3 – Was recorded for patients complaining from severe pain only during application of stimulus
4 – Was recorded for patients complaining from severe pain persisting after removal of stimulus

Only patients with teeth recorded a discomfort score of two or more were included in this study. (VRS) Records were recorded and tabulated. Then the teeth were cleaned, dried, and isolated with cotton rolls. Then the subjects included in this study were grouped into three groups of nine patients each according to the desensitizing agent received as follows;

Group I: A few drops of Gluma Desensitizer (Heraeus Kulzer, Armonk, NY, USA) (Dentsply, 5% Glutaraldytes and 35% hyroxyethyl methacrylate (HEMA) were applied with a cotton pellet using a gentle but firm rubbing motion. After 30 seconds, the area was dried thoroughly until the fluid disappeared and the surface was not shinny. Group II: A few drops of Seal & Protect (Di-and Trimethacrylate resins, PENTA, Silica, Triclosan, Cetylamine hydrofluoride and acetone) were applied to the dentin surface with an applicator tip. The surface was left undisturbed for 20 seconds and the excess solvent removed by gently airing for a few seconds and cured using Bluelex-LED (BlueLex, LD-105, San-Chong city, Taiwan) with constant mode of full intensity 800 mW/cm2 for 10 seconds. With a cotton pellet, the oxygen-inhibited layer was removed and the excess checked with a periodontal probe. Group III: Fluoride varnish (Fluoride Varnish, Dentsply Professional, York, Pa.) was applied for 1 minute. Excess gel was removed with a cotton pellet and the patients were advised not to drink or eat for the next hour after the application of the product in each group.

After the application of the three desensitizing agents, again the sensitivity test was done based on the (VRS) as previously mentioned to record the amount of reduction in the dentinal hypersensitivity.

In-office bleaching was applied for the patients of the three groups after application of the three desensitizing agents using the White smile Power bleaching system kit with 38% hydrogen peroxide. Bleaching procedures have been followed according to the manufacturer`s instructions and teeth subjected to the desensitizing agents were exposed also to the bleaching material.

White smile after bleaching Mousse containing potassium nitrate, fluoride and Xylitol was applied for all teeth exposed to bleaching procedures.

Once again, the sensitivity assessment test using the (VRS) was done after bleaching for the same specific examined teeth which were treated using the three different desensitizing agents. Hypersensitivity (VRS) scores before and after bleaching were recorded and statistically analysed using Chi square-test between groups. Statistical analysis was performed using Graphpad Prism-4 statistics software for Windows. P values $\leq 0.05$ are considered to be statistically significant in all tests.

## 3. Results

The criteria for evaluation of the degree of sensitivity were based on verbal rating scale. Results revealed that the dentinal hypersensitivity reduced significantly ($P<0.05$) after the application of the three different desensitizing agents as revealed by Chi square test (Chi value = 14.88, $p<0.05$). Yet, group of teeth treated with Fluoride varnish recorded the least reduction of the hypersensitivity in comparison with the two other desensitizing agents (Gluma and Seal & Protect) (Table 1 and Figure 1).

**Table (1): Verbal rate scores of dentinal hypersensitivity before and after application of three different desensitizing agents**

| Group / Score | Group 1 (Gluma) | | Group 2 (Seal &protect) | | Group 3 (Fluoride varnish) | |
|---|---|---|---|---|---|---|
| | Before | After | Before | After | Before | After |
| Score0 | 0% | 50% | 0% | 66.67% | 0% | 5.56% |
| Score1 | 0% | 50% | 0% | 33.33% | 0% | 94.44% |
| Score2 | 38.89% | 0% | 11.11% | 0% | 38.89% | 0% |
| Score3 | 38.89% | 0% | 50% | 0% | 44.44% | 0% |
| Score4 | 22.22% | 0% | 38.89% | 0% | 16.67% | 0% |
| Chi square test | Chi value | 36 | Chi value | 36 | Chi value | 36 |
| | p value | <0.0001* | p value | <0.0001* | p value | <0.0001* |

ns; non-significant ($p>0.05$) *; significant ($p<0.05$)

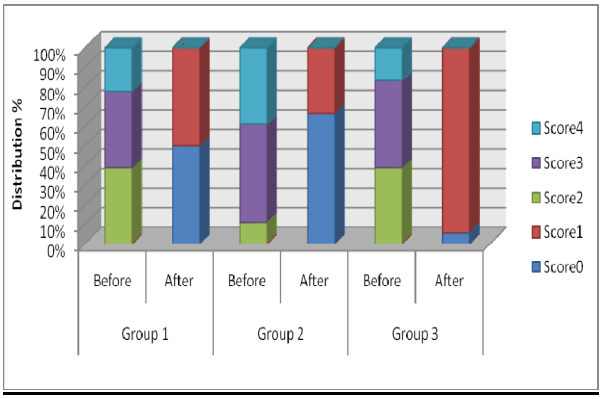


**Figure (1) A stacked column chart of verbal rate scores before and after application of the three desensitizing agents**

On the other hand, after application of the three desensitizing agents, it was found that the difference in dentinal hypersensitivity between teeth received Gluma and Seal & Protect before and after in-office bleaching was statistically non-significant as revealed by Chi square test ( $p>0.05$). While, for those teeth received the Fluoride varnish, a statistical significant difference was obtained before and after in-office bleaching (increased of the dentinal hypersensitivity) as revealed by Chi square test ( $p< 0.05$) (Table 2 and Figure 2,3,4)

**Table (2): Verbal rate scores of dentinal hypersensitivity after the application of the desensitizing agents before and after in-office bleaching**

| Group / Score | Group 1 | In-office Bleaching | Group 2 | In-office Bleaching | Group 3 | In-office Bleaching |
|---|---|---|---|---|---|---|
| Score0 | 50% | 50% | 66.67% | 66.67% | 5.56% | 0% |
| Score1 | 50% | 50% | 33.33% | 33.33% | 94.44% | 11.11% |
| Score2 | 0% | 0% | 0% | 0% | 0% | 61.11% |
| Score3 | 0% | 0% | 0% | 0% | 0% | 27.78% |
| Score4 | 0% | 0% | 0% | 0% | 0% | 0% |
| Chi square test | Chi value | 0.00 | Chi value | 0.00 | Chi value | 28.8 |
| | p value | 1ns | p value | 1ns | p value | <0.0001* |

ns; non-significant ($p>0.05$) *; significant ($p<0.05$)

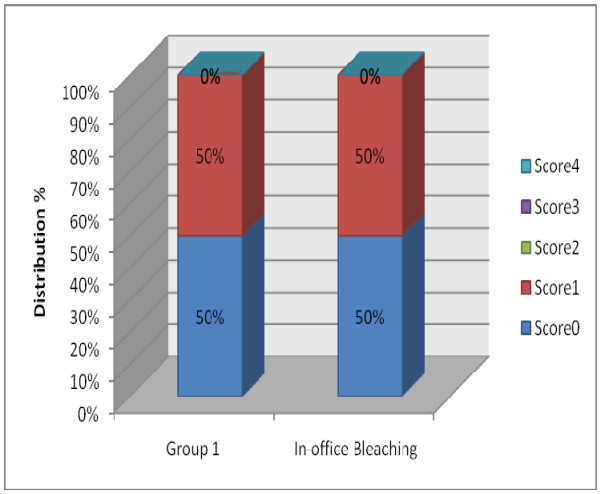


**Figure (2 ) A stacked column chart of verbal rate scores after application of Gluma desensitizing agent before (Group 1) and after in-office bleaching**

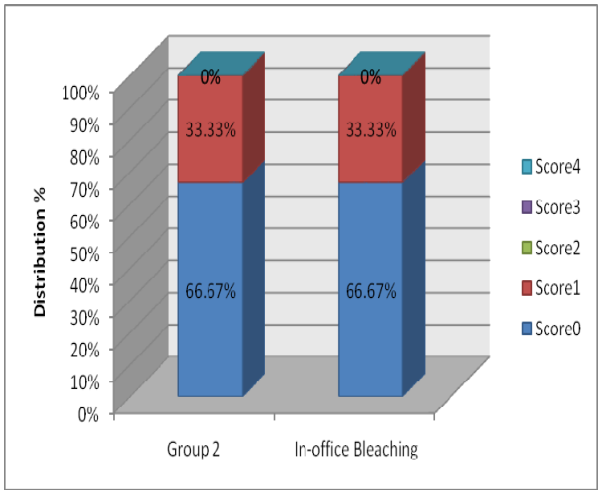


**Figure (3 ) A stacked column chart of verbal rate scores after application of Seal & Protect desensitizing agent before (Group2) and after in-office bleaching**

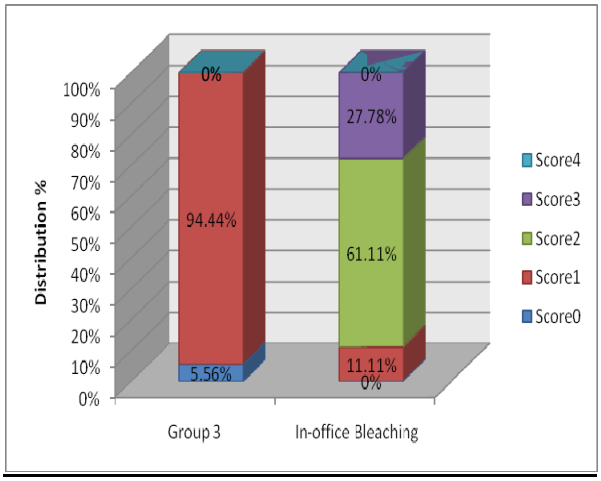


**Figure (4) A stacked column chart of verbal rate scores after application of Fluoride varnish desensitizing agent before (Group3) and after in-office bleaching**

**4. Discussion:**

Cervical dentin hypersensitivity is a significant clinical problem in dentistry because it affects a large percentage of the population due to erosion, abfraction, abrasion, ext,. Also, as life expectancy increases and patients retain their natural teeth longer because of more effective treatments for caries and periodontal disease, the risk of developing cervical dentin hypersensitivity increases as a result of physiological gingival recession and exposure of cervical dentin.

The new delivery system for the desensitizing agents proved to be effective and convenient for a single-patient application, with no drawbacks regarding handling and/or ease of application. In addition to their desensitizing effect, topical fluoride varnishes was found to play an important role for prevention of caries [13,14]. In this study, the results revealed that Gluma and the Seal & Protect showed superior results over the Fluoride varnish which showed less stability as a desensitizing agent after the application of the in-office bleaching agent.

The Gluma Desensitizer product contains 5% glutaraldehyde and 35% hydroxyethyl methacrylate (HEMA). The hypothesis for the immediate occlusion of the dentin tubules is an effect of glutaraldehyde on the proteins of the dentinal fluid. It was proposed that amino group-containing substances in dentin react with glutaraldehyde and start the formation of a HEMA polymer. It is conceivable that the ε-amino groups in these amino acids of a collagen molecule react with glutaraldehyde-derived aldehyde, forming cross-links where the two groups of aldehydes present in glutaraldehyde interlock themselves with the amino groups of dentin collagen, leading to a fixing of proteins, forming a protein precipitate resulting in partial or total occlusion ([15, 16]. The results of Gluma Desensitizer presented in this study are in agreement with the literature.[17,18,19,20]

While, the desensitizing agent Seal & Protect showed similar results to those shown by Gluma. The agent Seal & Protect is derived from the adhesive system Prime & Bond NT that has an anti-microbial characteristic, resulting from the incorporation of triclosan, and acid monomers, which are self-conditioning[21,22].

It was revealed from the results of this study that the in-office bleaching using the white smile bleaching system had no effect on the desensitizing effect of the Gluma and the seal & Protect desensitizing agents. And these findings were in accordance with the literature as it was concluded that the percentages of 38% hydrogen peroxide when applied according to the manufacturer instructions do not lead to increase in microleakage. Klukowsha [23] and White [24] also found that bleaching agents based of hydrogen, carbamide peroxide, and perborate did not cause an increase in microleakage at the interface adhesive.

But, on the other hand, the reduced effect of desensitization of Fluoride varnish after the application of in-office bleaching could be attributed to the effect of the high concentration of the hydrogen peroxide used in such type of in-office bleaching systems that might lead to the dissolution of the Fluoride varnish. However, the usage of fluoride varnish as a desensitizing agent could compromise the bleaching efficiency applied on the hypersensitive teeth.

**5. Conclusion:**

It is recommended to use resin-based desensitizing agents for treatment of the dentinal hypersensitivity when teeth are indicated for in-office bleaching to guarantee the sustainability of the desensitizing effect.

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