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A Comparative Evaluation of the Efficacy of Three Different Treatment Modalities in Dentin Hypersensitivity Management (An In Vivo Study)

Amir Husseiny Abdul-Hamid [1], Khalid Noaman[2], Ahmed Tharwat Al Ammary[3]

[1]*Assistant lecturer of Operative Dentistry Department, Faculty of Dental Medicine (Assuit-Branch), Al-Azhar University, Egypt.*

[2] *Professor and head of Operative Dentistry Department, Faculty of Dental Medicine, Boys, Cairo Al-Azhar University Egypt.*

[3] *Assistant Professor and head of Operative Dentistry Department, Faculty of Dental Medicine (Assuit-Branch), Al-Azhar University, Egypt.*

ABSTRACT

Objective : This study was conducted to evaluate the clinical effect of three different treatment modalities in management of dentin hypersensitivity.

patients and methods: Twenty seven hypersensitive teeth from nine patients were enrolled for this study. Patients were randomly divided into three groups according to desensitizing agents (Citrine varnish, Charm varnish and Gluma adhesive) **.** Patients assessment of dentin hypersensitivity was done before application of the agent (baseline) then 1 week, 4 weeks and 3 months respectively. Patients were asked to rate their perception to air stimuli by using and Visual Analogue Scale (VAS).

Results: The results of this clinical study revealed that there was high significant difference ($p \leq 0.05$) between pain scores before and after treatment for all tested groups. Totally there was statistically significant difference ($p \leq 0.05$) between the three groups as proven by Chi square test where Citrine varnish group was the highest followed by charm sense varnish group and the lowest was Gluma group in management of dentin hypersensitivity.

Conclusions: Citrine varnish , Charm varnish and Gluma were effective occluding dentinal tubules and alleviating the hypersensitivity symptoms, with citrine varnish being the most effective within 1 to 2 weeks and sustained up to 3 months.

Keywords: *Dentin hypersensitivity, Dentin desensitizing agents, Sodium fluoride , Gluma*.

I. Introduction

Dentin hypersensitivity (DH) is as an acute, nonspontaneous, short-duration pain resulting from exposure of the dentin to chemical, mechanical, osmotic, or thermal stimuli unlikely to be ascribed to any other form of dental pathology[(1,2)].

DH develops when dentinal tubules are exposed to oral cavity.The exposure of dentin and its resulting sensitivity is likely to be caused by one or two mechanisms: either with the removal of enamel or the exposure of the root surface with the loss of the overlying cementum[3-5].

The commonly accepted theory to explain the pain related to DH is the hydrodynamic theory [6].In the perspective of this theory, when dentinal tubules are exposed, the pressure differences in the surrounding tissue affect the flowing direction of the dentinal fluid inward and outward. This flowing may stimulate mechanoreceptors in intratubular nerves or in the superficial pulp
that is recognized by the patient in the form of a rapid and sharp pain [7].

There are several methods used for the treatment of DH. These methods include instructions for proper brushing, dietary advice, use of desensitizing products,the use of adhesive systems, and adhesive restorations [3, 8].

Fluoride varnishes were introduced on the market to increase the efficiency and permanence of fluoride when in contact with the tooth surface, in order to allow a slow and continuous release of fluoride [7].Varnishes consist of natural resin-based vehicles for fluoride, and are highly adhesive to the tooth structure. They are easy to apply and are low-cost materials [8].The fluoride is dissolved in an organic solvent, which evaporates when applied, leaving a thin layer of the material covering the exposed tooth surfaces. The mechanism of action is the deposition of calcium fluoride on the tooth surface, with the formation of fluorapatite[9].

A product containing the combination of an aqueous solution of 35% hydroxyethyl methacrylate and 5% glutaraldehyde is considered to be an efficient desensitizing agent. Dentinal tubules are inherently blocked by the glutaraldehyde, and this counteracts the hydrodynamic mechanism that gives rise to DH [10].Thus, the aim of this study was to compare three different treatment modalities in dentin hypersensitivity management in a randomized, split-mouth clinical trial. The hypothesis is that the tested management modalities will be affected DH differently.

II. Patients and methods

Case selection:

The study population was done on nine patients with twenty seven teeth with the complaint of dentin hypersensitivity in at least three quadrants were enrolled for this study. patient chartwas designed to recording of all observations and information described by patients, which include a detailed history, clinical examination, relevant information related to the hypersensitivity and precipitating causes, visual analogue score (VAS) scores to facilitate recall visits. The research protocol was approved by the ethics committee of faculty of dentistry, Al Azhar University, boy branch.

Inclusion Criteria:

1. Patients complaining of sensitivity due to mechanical stimuli (Tooth brushing), thermal (Warm, cold) or chemical (Sweet or sour food).
2. Patients in the age group of 18-45.
3. Presence of minimum of three hypersensitive teeth in each patient.
4. Patients ready to sign the consent form and ready to come for follow-ups

Exclusion Criteria:

1. Teeth with cervical caries.
2. Teeth with non-carious lesions with pulpal involvement.
3. Patients under any medications.
4. Patients having any systemic diseases.
5. Patients already taking any hypersensitivity treatment or had taken within last three months.
6. Teeth with advanced periodontal disease.

7. Crazed or hypoplastic teeth.

III. Observation

Patient assessment of dentin hypersensitivity*:*

Patient of dentin hypersensitivity was done before application of the agent then after one week, one month and three months respectively. The patients were educated to rate their perception to tactile, air and cold stimuli by using the Visual Analogue Scale (VAS).

Visual analog scale (VAS): A visual analog scale is a line 10 cm in length, the extremes of which represent the limits of pain: a patient might experience from an external stimulus (no pain at one end and severe pain at the other end of the line). Patients were asked to place a mark on the 10 cm line which indicated the intensity of their current level of sensitivity. Completed logs were collected at each evaluation. Specifically, 0(no pain) and 10 (extreme, unbearable pain .VAS pain intensity can be shown either as an absolute score value or as a percentage of the maximum.

IV. The treatment procedure:

The present study were used at least three quadrants, characterizing a ‘‘split-mouth’’ study. In each quadrant different desensitizing agents will be randomly applied. The study did not include a ‘‘placebo’’ group for ethical reasons.Hypersensitive teeth in each patient were randomly divided into three groups as stated previously.

The area to be treated was isolated with cotton rolls and was dried using air spray. The agents were applied at the cervical region of the tooth. Patients were instructed not to rinse or to take any food stuff for half an hour. This treatment was repeated at 1 week, 1 month and 3 months. The patients were demonstrated the proper brushing technique and were advised to use a soft tooth brush. Patients were advised to avoid intake of excessive dietary acids during the study period.

Nine patients with 27 sensitive teeth were divided into 3 main groups (n=9) according to desensitizing agents**.**

The statistical analysis of data

The statistical analysis using Analysis Of Variance (ANOVA) and Tukey's post-hoc test for comparison between VRS in the three groups using visual analogue scale..

V. Result

Patients expressed relief of pain on (VAS) after application of tested desensitizing agents at different follow up periods(1 week, 1 month and 3months) .

Comparison between VAS scores in the four groups: Table (1) represented the statistical analysis using Analysis Of Variance (ANOVA) and Tukey's post-hoc test for comparison between VRS in the three groups using visual analogue scale. **Before treatment**, there was no statistically significant difference between the three groups.

After one-week treatment, there was high statistically significant difference between the three groups. There was high statistically significant difference between Gluma group, which showed the highest value of mean VAS scores (4 ± 1), followed by Charm varnish group (3 ± 1), followed by Citrine varnish group with the lowest mean VAS scores (1 ± 0.5). **After 4-week treatment**, there was high statistically significant difference between the three groups. There was high statistically significant difference between Gluma group, which showed the highest value of mean VAS scores (1.05 ± 0.5), followed by Charm group (0.5 ± 0.6), followed by Citrine varnish group with the lowest mean VAS scores (0 ± 0). All teeth of the three groups reached the zero score after 4-week and 3-month follow-up period.

Table (1): Mean and standard deviation of hypersensitivity of three desensitizing agents at different follow up periods:

Group	GLUTA A Mean ± SD	Citrine varnish B Mean ± SD	Sharm sense varnish C Mean ± SD	p-value
Before Treatment	6^{a} ± 1.4	6.5^{a} ± 1.5	6.5^{a} ± 1.5	0.709 ns
After one week of treatment	4^{a} ± 1	1^{c} ± 0.5	3^{b} ± 1	<0.0001*
After 4 weeks of treatment	1.05^{a} ± 0.5	0^{c} ± 0	0.5^{b} ± 0.6	0.0002*
After 3 months of treatment	0^{a} ± 0	0^{a} ± 0	0^{a} ± 0	1 ns

*: Significnat at $p \leq 0.05$; different letter indicates significant difference at $\alpha = 0.05$ by Tukey's multiple comparison test.

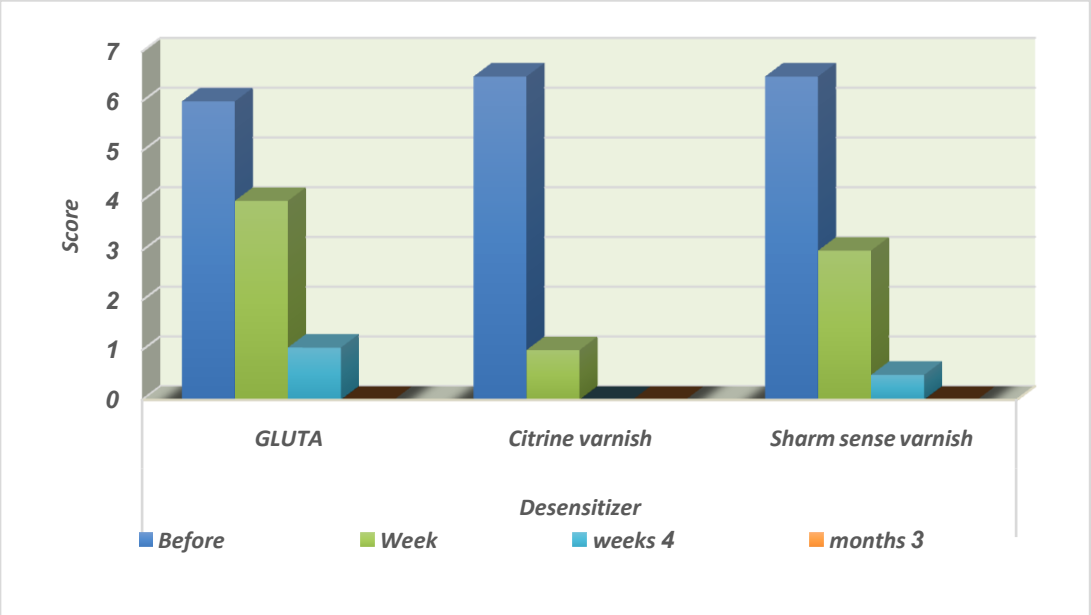

Fig. (1) Column chart showing VAS mean values in the three groups at different evaluation time

Table (2) represented the statistical analysis using the degree of change due to follow-up study for comparison between VAS in the three groups.

Mean percentage of Δ change between **before treatment** and **one-week after treatment** was the highest value (90%) with B group, followed by 55% with C group and the lowest value (35%) with A group. Mean percentage of Δ change between **before treatment** and **4 weeks after treatment** was the highest value (100%) with B group, followed by 95% with C group and the lowest value (83%) with A group. Mean percentage of Δ change between **before treatment** and **3-month treatment**, in all treatment groups, was 100% which denotes complete sustained relief of dentin hypersensitivity with VAS after 4 weeks of application and through follow-up period. Totally there was statistically significant difference between the three groups as proven by Chi square test where Citrine varnish group was the highest followed by charm sense varnish group while the lowest was Gluma group.

Table (2): Statistical analysis using the degree of change due to follow-up study comparison between VAS in the three groups

Mean of change Group	GLUTA A	Citrine varnish B	Sharm sense varnish C
Base one week	35%	90%	55%
Base 4 weeks	83%	100%	95%
Base 3 months	100%	100%	100%
Chi square test	0.0006*		

*: Significnat at $p \leq 0.05$

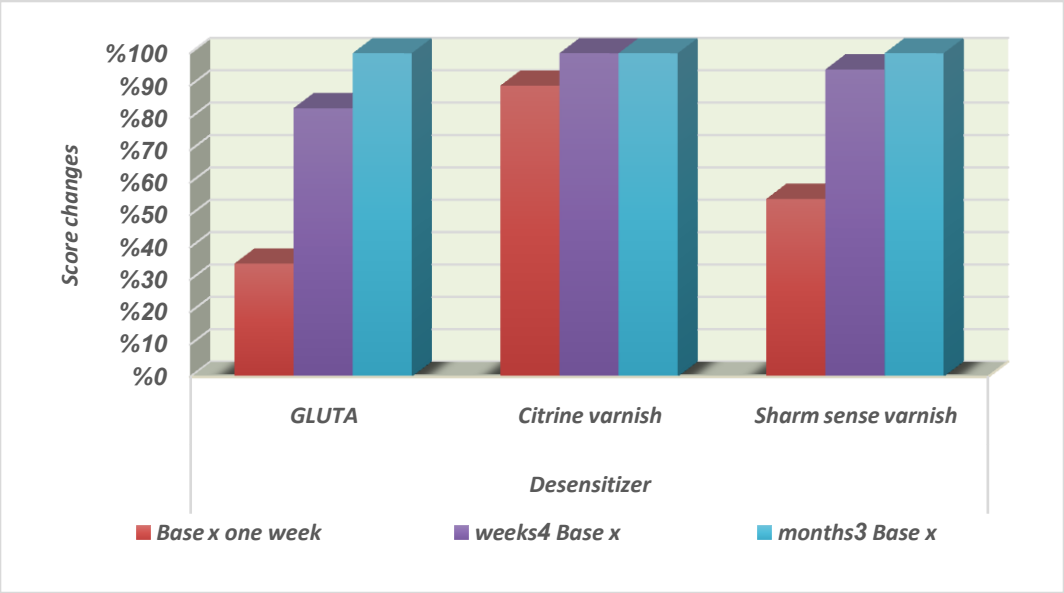

Fig. (2) Column chart showing %change of VAS in the three groups in different follow-ups from baseline using the probing stimulus

VI. Discussion

Dentin hypersensitivity is a very common painful problem which is difficult to solve, despite the fact that a large variety of treatment exist. Dentin hypersensitivity is characterized by a painful reaction due to the exposure of dentin to chemical, thermal, tactile or osmotic non-harmful stimuli according to the hydrodynamic theory, fluid movement in the dentinal tubules reaches mechanoreceptors in the periphery of the pulp and triggers pain. Consequently, dentin hypersensitivity is treated by sealing the dentinal tubules or depolarizing the pulp nerve fibers[(11)].

Gluma® (HeraeusKulzer GmbH, Hanau, Germany) is a commercially available desensitising agent consists of glutaraldehyde and hydroxyethyl methacrylate (HEMA). Glutaraldehyde occludes dentinal tubules by coagulation of amino acids and proteins present in the dentin, whereas HEMA can work by occluding the dentinal tubules [(12)]. HEMA penetrate deep into dentinal tubules because of its hydrophilic nature. Whereas the blocking effect of HEMA is reversible and the dentinal tubules become exposed after some time [(12)].

Sodium fluoride (NaF) has also been indicated for treating dentine hypersensitivity and it is available in a variety of forms. The use of fluoridating varnishes with sodium fluoride (in high concentrations) as the active ingredient has been advocated to increase time of action of NaF in contact with exposed dentin, thus aiming to enhance its effectiveness in decreasing dentine sensitivity[(13)].

The gradual action of NaF varnish may be attributed to the reaction that occurs between NaF and calcium ions of dentinal fluid and that leads to formation of calcium fluoride (CaF2) crystals, which are deposited on the dentinal tubules openings. As the crystal size of CaF2 is small (about 0,05 micrometers), a single application of NaF would not be effective in narrowing the diameter of dentinal tubules and multiple applications should be required.[14]

The ultimate test of any treatment is how well it works in the clinic. A randomized, blinded and controlled trial is the gold standard for determining the efficacy. A split mouth study design was chosen in this work which had advantages of same pain perception, oral hygiene habits, dietary habits and psychosomatic factors [15]**.** The patients act as his own control which is very powerful tool statistically, and the methodology of choice[16].

The VAS is considered preferable to a numerical rating scale whereby the subject rates pain intensity on a scale comprising of several distinct categories. Graphic rating scales, which are VAS, with descriptive terms placed at intervals along a 10-cm line, may have the advantage of helping patients to decide the position of their score. The investigators concluded that this type of rating provided the best available method for measuring pain or pain relief. [17]

Intergroup comparison showed a significant drop in sensitivity score at 1, 4 week and 3 months. The patients treated with NaF varnishesShowed a statistically significant reduction in VAS scores as compared to Glumagroup at 1, 2, and 4 weeks. At the end of 3 weeks, patients with Glumashowed a slightly higher drop in VAS score. A study conducted by Jalalian et al., [18] concluded that Glumawas less effective in reducing post crown preparation sensitivity as compared to potassium nitrate, their result is in aggrement with our study. Similarly, de AssisCde et [19] concluded from their clinical study that Gluma did not affect the management of root hypersensitive in patients treated by non-surgical periodontal therapy for a period up to 4weeks.

The result of the present study is disagree with the study conducted by Schupbach et al.[20]who reported Glumahas a long-term effect on the sensitivity induced by tooth preparation. In another clinical study[21]compared the effectiveness of desensitizer products, Glumashowed a significant reduction in VAS scores at post-treatment evaluation . Differences between our results and those of other studies may be related to the differences in dentin specimen utilized, etching process, time and mode of application of the desensitizing agent, or a combination of these variables. Significant differences in results can be produced on multiple applications and testing the materials under the vigorous conditions.

VII. Conclusion

It can be concluded that all desensitizing agents used in the current clinical study were effective in relieving dentin hypersensitivity. Citrine varnish and Charm varnish is a conservative effective method in reduction of the sensation of pain when compared with Gluma.

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