

Clinical evaluation of Gluma and Fluocal as desensitizing agents in the treatment of dentin hypersensitivity

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Abstract:

Background: Previous studies have indicated that the effectiveness of desensitizing agents in reducing dentin hypersensitivity is mainly depending on the occlusion of dentinal tubules. However, their long term ability to occlude dentinal tubules is not clarified yet. **Objectives:** To compare the effect of Gluma and Fluocal as desensitizing agents in the treatment of dentin hypersensitivity. **Methods:** Thirty six healthy adult having bilateral gingival recession of both maxillary and mandibular teeth was selected for the study. The method of sampling was a purposive sampling. After clinical evaluation, 98 teeth were selected from 36 patients who fulfilled the inclusion criteria. These 98 samples were divided equally into two groups. Group 1: The right sided teeth were treated by Gluma and Group 2: The left sided teeth were treated by Fluocal. Each tooth was subjected to cold, tactile and osmotic stimulus to assess the level of sensitivity, recorded by the VAS score prior to treatment and baseline, 1, 3, 6, & 12 months after topical treatment. Statistical analysis was performed using Chi-square (χ^2) test. A value of $p < 0.05$ was considered as statistically significant. **Results:** The result of this present study showed that both agents are capable of reducing dentin hypersensitivity at baseline and 1 month follow up observation but Gluma was more effective than Fluocal against all the test stimuli at 3, 6, & 12 months observation period in respect of no sensitivity. The differences between two groups were statistically significant ($p < 0.05$). **Conclusion:** It can be concluded that Gluma desensitizer is more effective compared to that of Fluocal in relieving dentin hypersensitivity.

Key words: Dentin hypersensitivity, Gluma, Fluocal, Desensitizing agents.

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Introduction:

Dentin hypersensitivity is a common complaint and is one of the most painful problems of teeth. It is defined as a short, sharp and well localized pain arising from exposed dentin in response to thermal, evaporative, tactile, osmotic or chemical stimuli which cannot be explained by any other dental defect or pathology¹. It is widely accepted that dentin hypersensitivity is an uncomfortable condition that also affects the function and quality of life.

There are many and varied etiological and predisposing factors related to dentin hypersensitivity. Exposed dentinal tubules either by loss of enamel due to attrition, abrasion and erosion or by loss of cementum due to gingival

recession is commonly cited². Brushing habits especially with harder bristled, dietary habit, Para functional habits, chewing tobacco and some diseases including gastro-esophageal reflux, acute and chronic gingival and periodontal diseases can also cause dentin hypersensitivity. It is a common side effect of tooth whitening procedure and removing calculus on the surface of the tooth by professionals³. Haywood stated that 55% to 75% of patients suffered from this whitening related sensitivity.

Another most common clinical cause of exposed dentinal tubules is gingival recession, because it causes exposure of root surface. Clinical studies have reported once gingival recession has exposed root surfaces, the cementum is rapidly lost from brushing with toothpaste and/or professional cleaning. It has also been reported that recession will increase over time with the use of hard-bristle brushes, excessive force and frequency of brushing. Frequency of gingival recession increases with age and is greater in men than in women⁴. The most common location of recession is the facial aspect of canines, premolars and molars. (The teeth most commonly affected are canines> premolars> incisors> molars⁵).

There are several theories for dentinal hypersensitivity, such as odontoblastic transduction theory, neural theory

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and hydrodynamic fluid theory. The most widely accepted theory for dentinal hypersensitivity is the hydrodynamic theory presented by Brannstrom and others which suggests that the fluids within the dentinal tubules flow due to thermal, mechanical, evaporative and osmotic stimuli. The flow of liquids in dentinal tubules can trigger nerves along the pulpal canal of dentin, causing pain. This hydrodynamic flow can be increased by hot, cold, sweet or sour beverages, cold air, aggressive flossing and brushing⁶.

There are two treatment options. These are plugging the dentinal tubules, preventing fluid flow and desensitizing the nerve, making it less responsive to stimulation. Several approaches and numerous agents have been investigated for treating dentinal hypersensitivity, including potassium nitrate, silver nitrate, zinc and strontium chloride, formaldehyde, gluteraldehyde, calcium hydroxide, sodium citrate, potassium oxalate, resin adhesives and fluorides³.

These cases must be managed efficiently, quickly and permanently. West in a recent review, it is conclusive that the evidence of successful treatment regimens of dentin hypersensitivity remains elusive, despite a multitude of products are available for treatment⁷. The efficacies of these products are varied, not well established and unpredictable. Therefore, clinicians are left to determine the most satisfactory and effective treatment approach for the relief of dentin hypersensitivity for patients in their practices⁸.

Two topical desensitizers were employed in this study. One is Gluma desensitizer; (Heraeus Kulzer, Germany) a non-fluoride product containing 5% gluteraldehyde and 35% hydroxyethyl methacrylate (HEMA) reduce dentinal hypersensitivity by occluding tubules possibly by precipitating plasma proteins in dentinal fluids. Another is Fluocal solute (Septodont, France) a fluoride containing product composed of 1% sodium fluoride reduce dentinal hypersensitivity by precipitating fluoride compounds and mechanically occlude the exposed dentinal tubules blocking the transmission of the stimuli.

Only a few studies evaluated the effectiveness of the desensitizing agents in vivo. Hence, it was considered that this study assess the efficacy of these desensitizing agents in providing relief from dentin hypersensitivity and help the clinician to choose the effective treatment solution for dentin hypersensitivity.

Materials and Methods:

Thirty six healthy adult individual having bilateral gingival recession of both maxillary and mandibular teeth was

selected for the study from outpatient department of conservative dentistry and endodontics, BSMMU. Data was collected and the written consent taken from the patient to assess the dentin hypersensitivity. A detailed medical and dental history was recorded. After clinical evaluation, 98 teeth were selected from 36 patients who fulfilled the inclusion criteria. The materials used in this study were Gluma desensitizer and Fluocal solute. These 98 samples were divided into two groups. Group 1: The right sided teeth were treated by Gluma and Group 2: The left sided teeth were treated by Fluocal. Sensitivity was assessed by means of cold, tactile and osmotic stimuli. All the stimuli were applied on the cervical region of the experimental teeth. The adjacent teeth were isolated with cotton rolls and a suction device was used to control saliva. Cold water of 9⁰ c temperature was filled in a 5 ml disposable syringe and applied at 0.5 cm distance to the cervical region of experimental tooth surface. Tactile stimulus was done by a sharp explorer with gentle pressure perpendicular to the long axis of the tooth and osmotic stimulus was done by glucose solution prepared with 25 gm glucose in 100 ml of water. The patients were given a VAS (Visual Analog Scale) upon which they asked to place a pencil mark at a point marked from 0 to 10 to describe the pain experienced. The extreme left side indicated zero pain and the extreme right, maximal pain. The sensitivity score was 1-3 (mild pain), 4-6 (moderate pain) and 7-9 (severe pain). Visual Analog Scale (VAS) is used to measure the pain score of human subjective states in clinical research but no other device to measure hypersensitivity. Both pain and sensitivity are expressed by the patient as an unpleasant sensation, so in this study VAS was used to measure the sensitivity level of study subjects.

The manufactures instructions were followed during the application of the materials. Prior to the application of desensitizing agents, the experimental teeth were dried and isolated with cotton rolls and a suction device. For Gluma desensitizer, two coatings were applied. First, a few drop of Gluma were applied with a micro brush using a gentle but firm rubbing motion. After 30 seconds, the area was dried with a damp cotton pellet until the fluid disappeared and the surface was not shiny. Another coating was applied in the same manner. Fluocal was also applied in two coatings using micro brush. It was applied for 1 minute and excess was removed with a cotton pellet. The baseline measurement of the dentin hypersensitivity was recorded by using a visual analog scale (VAS). All patients were recalled at 1, 3, 6 & 12 months and a new VAS analysis were conducted for assessment of their sensitivity level in each observation period.

Results:

In this present study, the sensitivity level of study teeth which was treated either by Gluma or Fluocal and then subjected to cold, tactile and osmotic stimulus were clinically evaluated at baseline, 1, 3, 6, and 12 months observation period by VAS score. The descriptive statistics of two groups are given in table 1, 2 and 3.

Data were expressed in number and percentage. Statistical analysis was done by Chi-square test. The test of significance was calculated and p values <0.05 was accepted as level of significance.

Table-I shows the comparison of sensitivity level of the study teeth by cold stimulus between Gluma and Fluocal groups following each observation period. It was observed that at baseline and after 1 month follow up observation between two groups the differences were not statistically significant ($p > 0.05$). But after 3, 6 and 12 months follow up in respect of no sensitivity the differences between two groups were statistically significant ($p < 0.05$). Moderate sensitivity at 6 & 12 months and severe sensitivity at 12 months follow up also statistically significant.

Table-I
Comparison of sensitivity level (VAS score) between two groups by cold stimulus (n=98 teeth)

Sensitivity level (VAS score) by cold stimulus	Group 1 Gluma desensitizer (n=49 teeth)		Group 2 Fluocal (n=49 teeth)		P value
	No.	%	No.	%	
Baseline					
No sensitivity	33	67.3%	30	61.2%	P = 0.522
Mild sensitivity	10	20.4%	8	16.3%	P = 0.601
Moderate sensitivity	4	8.2%	7	14.3%	P = 0.299
Severe sensitivity	2	4.1%	4	8.2%	P = 0.400
After 1 month					
No sensitivity	33	67.3%	30	61.2%	P = 0.522
Mild sensitivity	10	20.4%	8	16.3%	P = 0.601
Moderate sensitivity	4	8.2%	7	14.3%	P = 0.299
Severe sensitivity	2	4.1%	4	8.2%	P = 0.400
After 3 months					
No sensitivity	39	79.6%	28	57.1%	P = 0.016*
Mild sensitivity	6	12.2%	10	20.4%	P = 0.274
Moderate sensitivity	2	4.1%	7	14.3%	P = 0.080
Severe sensitivity	2	4.1%	4	8.2%	P = 0.400
After 6 months					
No sensitivity	40	81.6%	24	49.0%	P = 0.001*
Mild sensitivity	5	10.2%	7	14.3%	P = 0.538
Moderate sensitivity	2	4.1%	13	26.5%	P = 0.002*
Severe sensitivity	2	4.1%	5	10.2%	P = 0.239
After 12 months					
No sensitivity	40	81.6%	21	42.9%	P = 0.002*
Mild sensitivity	5	10.2%	6	12.2%	P = 0.751
Moderate sensitivity	2	4.1%	13	26.5%	P = 0.002*
Severe sensitivity	2	4.1%	9	18.4%	P = 0.025*

n = number of samples

* = statistically significant ($P < 0.05$)

Data were expressed in number and percentage. Statistical analysis was done by Chi-square test. The test of significance was calculated and p values <0.05 was accepted as level of significance.

Table-II shows the comparison of sensitivity level of the study teeth by tactile stimulus between Gluma and Fluocal groups following each observation period. It was observed that at baseline and after 1 month follow up observation between two groups the differences were not statistically significant ($p > 0.05$). But after 3, 6 and 12 months follow up in respect of no sensitivity and moderate sensitivity the differences between two groups were statistically significant ($p < 0.05$). Severe sensitivity at 12 months follow up also statistically significant.

Data were expressed in number and percentage. Statistical analysis was done by Chi-square test. The test of significance was calculated and p values <0.05 was accepted as level of significance.

Table-III shows the comparison of sensitivity level of the study teeth by osmotic stimulus between Gluma and Fluocal groups following each observation period. It was observed that at baseline and after 1 month follow up observation between two groups the differences were not statistically significant ($p > 0.05$). But after 3, 6 and 12 months follow up in respect of no sensitivity the differences between two groups were statistically significant ($p < 0.05$). Moderate sensitivity at 6 & 12 months and severe sensitivity at 12 months follow up also statistically significant.

Table-II

Comparison of sensitivity level (VAS score) between two groups by tactile stimulus (n=98 teeth)

Sensitivity level (VAS score) by tactile stimulus	Group 1		Group 2		P value
	Gluma desensitizer (n=49 teeth)		Fluocal (n=49 teeth)		
	No.	%	No.	%	
Baseline					
No sensitivity	33	67.3%	30	61.2%	P = 0.522
Mild sensitivity	12	24.5%	10	20.4%	P = 0.336
Moderate sensitivity	2	4.1%	7	14.3%	P = 0.080
Severe sensitivity	2	4.1%	2	4.1%	P = 1.00
After 1 month					
No sensitivity	33	67.3%	30	61.2%	P = 0.522
Mild sensitivity	11	22.4%	10	20.4%	P = 0.296
Moderate sensitivity	3	6.1%	7	14.3%	P = 0.090
Severe sensitivity	2	4.1%	2	6.1%	P = 1.00
After 3 months					
No sensitivity	37	75.5%	24	49.0%	P = 0.002*
Mild sensitivity	7	14.3%	8	16.3%	P = 0.777
Moderate sensitivity	3	6.1%	15	30.6%	P = 0.001*
Severe sensitivity	2	4.1%	2	4.1%	P = 1.00
After 6 months					
No sensitivity	40	81.6%	21	42.9%	P = 0.002*
Mild sensitivity	5	10.2%	8	16.3%	P = 0.371
Moderate sensitivity	2	4.1%	15	34.7%	P = 0.000*
Severe sensitivity	2	4.1%	5	6.1%	P = 0.239
After 12 months					
No sensitivity	40	81.6%	20	40.8%	P = 0.000*
Mild sensitivity	5	10.2%	7	14.3%	P = 0.538
Moderate sensitivity	2	4.1%	13	26.5%	P = 0.002*
Severe sensitivity	2	4.1%	9	18.4%	P = 0.025*

n= number of samples

* = Statistically significant ($p < 0.05$).

Table-III
Comparison of sensitivity level (VAS score) between two groups by osmotic stimulus (n=98 teeth)

Sensitivity level (VAS score) by osmotic stimulus	Group 1		Group 2		P value
	Gluma desensitizer (n=49 teeth)		Fluocal (n=49 teeth)		
	No.	%	No.	%	
Baseline					
No sensitivity	33	67.3%	30	61.2%	P = 0.522
Mild sensitivity	12	24.5%	8	16.3%	P = 0.431
Moderate sensitivity	2	4.1%	7	14.3%	P = 0.080
Severe sensitivity	2	4.1%	4	8.2%	P = 0.400
After 1 month					
No sensitivity	33	67.3%	30	61.2%	P = 0.522
Mild sensitivity	12	24.5%	8	16.3%	P = 0.431
Moderate sensitivity	2	4.1%	7	14.3%	P = 0.080
Severe sensitivity	2	4.1%	4	8.2%	P = 0.400
After 3 months					
No sensitivity	40	81.6%	30	61.2%	P = 0.000*
Mild sensitivity	5	10.2%	8	16.3%	P = 0.371
Moderate sensitivity	2	4.1%	7	14.3%	P = 0.080
Severe sensitivity	2	4.1%	4	8.2%	P = 0.400
After 6 months					
No sensitivity	42	85.7%	21	42.9%	P = 0.000*
Mild sensitivity	3	6.1%	9	18.4%	P = 0.064
Moderate sensitivity	2	4.1%	15	30.6%	P = 0.000*
Severe sensitivity	2	4.1%	4	8.2%	P = 0.400
After 12 months					
No sensitivity	42	85.7%	20	40.8%	p = 0.000*
Mild sensitivity	3	6.1%	5	10.2%	p = 0.538
Moderate sensitivity	2	4.1%	15	30.6%	p = 0.000*
Severe sensitivity	2	4.1%	9	18.4%	p = 0.025*

n= number of samples

* = Statistically significant (p < 0.05).

Discussion:

In this present study, it was found that Gluma desensitizer and Fluocal were capable of reducing dentin hypersensitivity at the baseline and after 1 month follow up observation; there were no statistically significant differences found between the two groups. However, at 3, 6 & 12 months observation period, significant differences were found between Gluma and Fluocal against all the testing stimuli in respect of no sensitivity. The numbers of sensitivity less tooth in Gluma was increased until the end of the study. On the other hand, the number of sensitivity less tooth was decreased after 6 and 12 months observation period regarding Fluocal.

In this present study, the effectiveness of the Gluma and Fluocal in reducing dentin hypersensitivity was evaluated

with VAS, which is widely used in human clinical research to assess subjective states. It is based on a 10 mm scale; the extreme left side indicated zero point and the extreme right, indicated maximal pain. Research subjects are asked to indicate their response by marking a position on the line between the two extremes⁹.

Previous in vitro and in vivo studies have indicated that dentin hypersensitivity could be reduced following application of desensitizing agents. However, their long term effectiveness is still controversial. Therefore, evaluation of sensitivity by comparing between Gluma and Fluocal was the prime focus of this study.

The results found in this study were consistent with some of the previous studies. Dondi dall'Orologio et al. found

single topical treatments of hypersensitive teeth with Gluma desensitizer eliminated or at least significantly reduced dentin sensitivity throughout the 6 month observation time. The glutaraldehyde-based agent (Gluma) was proven more efficient in treating cervical dentin hypersensitivity up to the 9-month follow up¹⁰.

The mechanism of reducing sensitivity in Gluma is not clarified in this present study. But according to previous study, it can be stated that as Gluma desensitizer product contains 5% glutaraldehyde and 35% hydroxyethyl methacrylate (HEMA), which is capable to immediate occlusion of the dentinal tubules. The reason for immediate occlusion of the dentinal tubules is an effect of glutaraldehyde on the proteins of the dentinal tubules. In the reaction of glutaraldehyde with dentin, the two groups of aldehyde (present in glutaraldehyde) interlace themselves with the amino groups of dentin collagen, leading to fixing proteins forming a barrier and polymerization of HEMA leaving a thin films of polymerized material on the dentin surface. The positive result of Gluma desensitizer presented in this study is in agreement with the literature¹⁰. Furthermore, the highly significant decrease the sensitivity score in Gluma may be due to glutaraldehyde because it kills the bacteria and coagulates plasma protein within the dentinal fluids, forming a coagulation plug³.

On the other hand, the present study revealed that Fluocal is also capable of reducing dentin hypersensitivity at baseline and 1 month observation period. However, its effectiveness is reduced following elapse of time. The results were consistent with other literature who evaluated the effectiveness of four topical desensitizing agents (Gluma, Duraphat, 2% fluoride iontophoresis, copal varnish) in providing short term relief of dentin hypersensitivity. The results found that, all agents caused a statistically significant reduction in dentin hypersensitivity within 24 hours of treatment. These findings are consistent with the result of prevailing study. The authors of the current study also found Gluma to be the most effective agents without significant difference with others at baseline but its long term effect has a significant difference with other materials. This is also confirmed by Ritter AV, Dias WL, et al. (2006).

The mechanism of Fluocal in reducing dentin hypersensitivity as well as the reason of short term relief¹¹. Fluocal contains 1% NaF, which helps in remineralization and reacts chemically with the calcium and phosphate ions providing a precipitation of CaF₂ crystals within the dentinal tubules and reduces the sensitivity by occluding the tubules. Though this crystal acts as a reservoir for releasing fluoride but it is an unstable compound. So, it

dissociates gradually after application and its effect is of short duration.

Therefore, based on the present study and together with the previous studies, it can be considered that Gluma reduce dentin hypersensitivity more effectively than that of Fluocal.

It should be considered that the evaluation of treatments for dentin hypersensitivity is not a simple procedure due to the natural desensitization of dentin, the mechanical occlusion of the dentinal tubules by secondary dentin and pain may be changes by subject's emotional component. Though this study represents Gluma desensitizer provides long term reduction of dentin hypersensitivity but multiple studies should be conducted to investigate the real benefits of this material before recommending their routine application in dentistry.

Conclusion:

It can be concluded that in respect to long term reducing of dentin hypersensitivity, Gluma is more effective than that of Fluocal.

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