A CLINICAL COMPARISON OF IN -OFFICE MANAGEMENT OF DENTIN HYPERSENSITIVITY IN A SHORT TERM TREATMENT PERIOD

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Abstract

Objective: To determine the differences in efficiency of four desensitizing agents in relieving dentin hypersensitivity in a time period of 2 weeks.

Material and methods: 50 participants who responded positively to intraoral testing for dentin hypersensitivity using a split-mouth-designed study were recruited for the study. Sensitivity was assessed by means of thermal and thermal/evaporative stimuli using VAS (visual analogue scale). After recording the baseline scores, the patients were randomly assigned to treatment with the desensitising agents -Clinpro XT varnish (Group I), Gluma power gel (Group II), Bifluoride 12 varnish (Group III) , GC Tooth Mousse plus (Group IV). After 10 minutes the patient's responses was recorded. The follow-up was done after 1week and again after 2 weeks from the time of application of the agents.

Results: All the four desensitizing agents were successful in relieving the sensitivity of the patients. Multiple group comparison between groups showed highly significant differences, Group I showed maximum effectiveness followed by Group IV, Group II,& Group III after 10mins. The effectiveness of agents after 1 week was in the same order. However after 2 weeks it was seen that group I was most effective followed by group II & group IV, with Group III being the least effective.

Conclusion: Dental professionals need to understand the causes of dentin hypersensitivity. Once a diagnosis has been made and the factors have been identified a treatment plan can be outlined to the patient for the treatment of dentin hypersensitivity.

Keywords: Dentin hypersensitivity, pain, hydrodynamic theory, dentine, sensitivity.

1. Introduction

Tooth sensitivity is a significant clinical problem which is frequently encountered in clinical practice which can be a very frustrating oral condition for both patients and clinicians alike[1, 2,3]. Dental hypersensitivity is referred as pain arising from exposed dentine, typically in response to tactile, thermal, chemical, or osmotic stimuli that cannot be explained as arising from any other form of dental defect or pathology.

The International Association for Study of Pain (IASP) has ascribed the term "allodynia" for such pain and this should probably be modified to "allodontia" as it concerns the tooth. The most common factors responsible for dentine hypersensitivity are abrasion, caused by tooth brushing with inadequate intensity; abfraction, caused by tooth flexion associated with ill-directed occlusal forces, parafunctional habits or occlusal disequilibrium; erosion, as an effect of acids in the oral cavity; anatomic predisposition due to structural deficiency in the enamel-cementum junction; cavity preparations in teeth with pulp vitality that expose the dentine; as well as improperly controlled dentinal acid conditioning[1, 4,5].

There are various desensitizing agents (dentifrices, gels, varnishes, tooth mousse, solutions) and techniques used for the treatment of dentinal hypersensitivity. The therapeutic aims of office and home based treatments are to interrupt the pulpal neural response or to block the sensitive mechanisms through tubule occlusion [2].It is a domain where man has continued his pursuit towards approximation of that gold standard for its management.

The management of this condition requires a good understanding of the complexity of the problem, as well as a variety of treatments available. Thus it is imperative that every dentist should have a basic understanding of this chronic condition.

West, in a recent review, hinted that conclusive evidence of successful treatment regimes of dentin hypersensitivity remains elusive, despite a multitude of products available for treatment. 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 practices.[3] Only a few studies have evaluated the effectiveness of the desensitizing agents in vivo. Hence, it was considered worthwhile to assess the efficacy of the desensitizing agents in providing short-term relief from dentin hypersensitivity and to help the clinician choose the most effective treatment solution for dentin hypersensitivity. The reduction of hypersensitivity in a two week evaluation period using four in office desensitizing agents with different mechanism of actions will be assessed.

2. Materials:

S. No.	MATERIALS	MANUFACTURER	COMPOSITION
1	Clinpro XT varnish	3M ESPE	Resin-modified glass ionomer material that releases fluoride, calcium and phosphate.
2	Gluma	Kulzer	2-hydroxyethyl methacrylate , glutaraldehyde
3	GC tooth mousse	GC Corporation, Tokyo	glycerol Propylene glycol , Recaldent CPP-ACP (Casein phosphopeptide - amorphous calcium phosphate) D-glucitol , Colloidal Silica , Sodium carboxyl methyl cellulose , titanium dioxide ,xylitol ,phosphoric acid , Sodium saccharin ,zinc oxide , magnesium oxide ,ethyl 4-hydroxybenzoate ,propyl 4-hydroxybenzoate .
4	Bifluoride 12	Voco	sodium fluoride, calcium fluoride. ethyl acetate, pyroxylin, colloidal silicon dioxide, clove.

3. Methodology:

3.1 Participants: Patients who visit the outpatient clinic of the Department of Conservative Dentistry & Endodontics. A.B. Shetty Memorial Institute of Dental Sciences, Mangalore for dental hypersensitivity complaints were assessed for inclusion into the study group.

We recruited 50 participants who respond positively to intraoral testing for dentin hypersensitivity using a split-mouth-designed study.

Our other inclusion criteria were that the participants be in good general health, be at least 20 years old and have at least two teeth(canine and premolar) in different quadrants of their mouth that are moderately sensitive to tactile or air stimuli.

We excluded patients from the study if they meet any of the following criteria:

Have a known allergy to any of the ingredients in the treatment materials used, are receiving periodontal therapy or had received nonsurgical periodontal treatment within the previous three months, are taking any kind of medication, are pregnant or lactating, patients who received professional treatment with desensitizing agents in the previous six months, have had any cervical caries or deep abrasions requiring class V fillings, or had a fractured or endodontically treated teeth or teeth with large restorations.

The participants were provided with detailed information, both orally and in written form, about the principles of treatment and purpose of the study.

3.2 Treatment Procedure: Sensitivity was assessed by means of thermal and thermal/evaporative stimuli. A blast of water and a blast of air was applied at a 0.5 cm

distance to the tooth surface. All the stimuli was applied on the cervical region of the experimental teeth and the adjacent teeth isolated with cotton rolls.

The patients was given a VAS (Visual Analogue Scale) upon which they were asked to describe the pain experienced. The VAS is a 10 cm line with the anchor words “no pain” (0 -cm) and “intolerable pain” (10-cm) at opposite ends. Each patient was asked to place a vertical mark on the VAS to indicate the intensity of his or her level of sensitivity after receiving stimuli.

After recording the initial scores, the patients were randomly assigned to treatment with the desensitising agents. All agents were applied by the same operator as per the manufacturer’s instructions. We have used the split mouth design study. In each patient, each quadrant received different treatment module according to manufactures instructions.

First Quadrant: Treated with Clinpro XT varnish (Group I)

Second Quadrant: Treated with Gluma power gel (Group II)

Third Quadrant: Treated with Bifluoride 12 varnish (Group III)

Fourth Quadrant: Treated with GC Tooth Mousse plus (Group IV)

After 10 minutes the patient’s responses was recorded according to VAS in the same manner and with the same order of stimuli as before. The follow-up was done after 1week and again after 2 weeks from the time of application of the agents.

4. Results:

Table I: Mean and standard deviation values of the various groups at different time intervals

Material		N	Minimum	Maximum	Mean	Std. Deviation	Median
3M ESPE	Baseline	50	3	9	5.94	1.504	6.00
	after 10 min	50	0	2	0.54	0.646	0.00
	after 1 week	50	0	2	0.88	0.659	1.00
	after 2 week	50	0	2	1.00	0.571	1.00
GLUMA	Baseline	50	3	9	5.40	1.414	5.00
	after 10 min	50	0	3	1.42	0.971	1.00
	after 1 week	50	1	4	2.62	1.086	3.00
	after 2 week	50	1	4	2.58	1.090	2.00
BIFLUORID12	Baseline	50	4	9	6.16	1.167	6.00
	after 10 min	50	0	4	1.94	0.935	2.00
	after 1 week	50	1	6	3.54	1.073	4.00
	after 2 week	50	2	7	4.02	1.186	4.00
GC TOOTH MOUSSE	Baseline	50	4	9	5.84	1.299	5.50
	after 10 min	50	0	3	1.32	0.868	1.00
	after 1 week	50	1	4	2.58	0.810	3.00
	after 2 week	50	1	5	2.66	0.848	3.00

Table II: Two factor ANOVA for repeated measures

Application	Material	N	Mean	Std. Deviation
Before application- after 10 minutes	3M ESPE	50	5.40	1.552
	GLUMA	50	3.98	1.610
	BIFLUORID 12	50	4.22	1.217
	GC TOOTH MOUSSE	50	4.52	1.297
Before application- after 1 week	3M ESPE	50	5.06	1.504
	GLUMA	50	2.78	1.607
	BIFLUORID 12	50	2.62	1.469
	GC TOOTH MOUSSE	50	3.26	1.006
Before application- after 2 weeks	3M ESPE	50	4.94	1.490
	GLUMA	50	2.82	1.625
	BIFLUORID 12	50	2.14	1.629
	GC TOOTH MOUSSE	50	3.18	1.063

Table III: Value of mean discomfort scores from baseline to different time intervals for all groups.

Material	(I)Factor1	(J)Factor1	Mean Difference (I-J)	Std. Error	p	
3M ESPE	Before application	After 10 min	5.400	0.219	.000	HS
		After 1 week	5.060	0.213	.000	HS
		After 2 weeks	4.940	0.211	.000	HS
GLUMA	Before application	After 10 min	3.980	0.228	.000	HS
		After 1 week	2.780	0.227	.000	HS
		After 2 weeks	2.820	0.230	.000	HS
BIFLUORID 12	Before application	After 10 min	4.220	0.172	.000	HS
		After 1 week	2.620	0.208	.000	HS
		After 2 weeks	2.140	0.230	.000	HS
GC TOOTH MOUSSE	Before application	After 10 min	4.520	0.183	.000	HS
		After 1 week	3.260	0.142	.000	HS
		After 2 weeks	3.180	0.150	.000	HS

Table IV: Intergroup Comparisons Values (Bonferroni)

Dependant Variable	(I) Material	(J) Material	Mean Difference (I-J)	Std. Error	p	
Baseline - after 10 minutes	3M ESPE	GLUMA	1.420	.286	.000	HS
		BIFLUORID 12	1.180	.286	.000	HS
		GC TOOTH MOUSSE	.880	.286	.014	HS
	GLUMA	BIFLUORID 12	-.240	.286	1.000	NS
		GC TOOTH MOUSSE	-.540	.286	.361	NS
	BIFLUORID 12	GC TOOTH MOUSSE	-.300	.286	1.000	NS
Baseline -after 1 week	3M ESPE	GLUMA	2.280	.283	.000	HS
		BIFLUORID 12	2.440	.283	.000	HS
		GC TOOTH MOUSSE	1.800	.283	.000	HS
	GLUMA	BIFLUORID 12	.160	.283	1.000	NS
		GC TOOTH MOUSSE	-.480	.283	.550	NS
	BIFLUORID 12	GC TOOTH MOUSSE	-.640	.283	.149	NS
Baseline -after 2 weeks	3M ESPE	GLUMA	2.120	.294	.000	HS
		BIFLUORID 12	2.800	.294	.000	HS
		GC TOOTH MOUSSE	1.760	.294	.000	HS
	GLUMA	BIFLUORID 12	.680	.294	.131	NS
		GC TOOTH MOUSSE	-.360	.294	1.000	NS
	BIFLUORID 12	GC TOOTH MOUSSE	-1.0400	.294	.003	HS

The results were statistically analysed using two factor ANOVA for repeated measures, Pairwise comparisions by Bonferonni test and multilpe comparisions between groups.VAS was used for the analysis of effectiveness of the four desensitising agents where 0 was the most effective and 10 was least effective.

The mean sensitivity scores were recorded prior to topical treatment (baseline score)and after the application of desensitising agents(post treatment) after 10min,1week, & 2 week. The scores showed varying decrease of sensitivity for each group (Table I).

Results showed that the effect of the agents was maximum after 10 min which gradually decreased overtime till the last recording after 2 weeks (Table II).Multiple group comparision (Table IV) between groups also showed highly significant differences, Group I(Clinpro XT) showed maximum effectiveness followed by

Group IV (GC tooth mousse),Group II (Gluma),& Group III(Bifluoride 12) after 10mins. The effectiveness of agents after 1 week was in the same order. However after 2 weeks it was seen that group I was most effective followed by group II & group IV, with Group III being the least effective. Overall the result shows that the material Clinpro XT shows significant changes after 10 min, 1 week and 2 weeks as compared to other desensitising agents.

Discussion

Dentine hypersensitivity is a very common painful problem which is difficult to solve, despite the fact that a large variety of treatments exist. The occurrence of hypersensitivity is due to abrasion , abfraction , particularly important as an adverse event of periodontal therapy. It has been demonstrated that root exposure due to loss of attachment and shrinkage of periodontal tissues leads to exposure of the cemento-enamel junction and tooth hypersensitivity [6, 7]. Taking these facts into consideration, there is a need to develop treatment approaches which permit the relief of the symptoms of dentine hypersensitivity.

Dentin is sensitive due to its anatomy and physiology. It is a porous, mineralized connective tissue with an organic matrix of collagenous proteins and an inorganic omponent, hydroxyapatite. Dentinal tubules are micro-canals that radiate outward through the dentin from the pulp cavity to the dentinal surface, with different configurations and diameters in different teeth. For human dentin, one square millimeter can contain 30,000 tubules, depending on depth. Each tubule contains a Tomes fiber (cytoplastic cell process) and an odontoblast that communicates with the pulp. Within the dentinal tubules there are two types of nerve fibers, myelinated (A-fibers) and unmyelinated (C-fibers).[8] The A-fibers are responsible for the sensation of dentinal hypersensitivity, perceived as pain in response to all stimuli. The most widely accepted mechanism of dentinal sensitivity is the hydrodynamic theory, first described by Brännstrom[4,9]. In this model, the aspiration of odontoblasts into the dentinal tubules, as an immediate effect of physical stimuli applied to exposed dentin, results in the outward flow of the tubular contents (dentinal fluids) through capillary action. The changes to the dentinal surface lead to stimulation of the A-type nerve fibres surrounding the odontoblasts.

Another theory is an alteration in pulpal sensory nerve activity[10]. The treatment of exposed, open dentinal tubules is based upon the physiology of the stimulus response.

More than one stimulus to assess pain was used, according to the recommendation of Holland et al[11] (1997). This recommendation arises from the fact that different stimuli can elicit different pain sensations and could lead to more reliable conclusions. Blasts of water and air were used as thermal and thermal/evaporative stimuli, respectively. Pain associated with dentine hypersensitivity is difficult to quantify and reproduce. The Visual Analogue Scale (VAS) has been reported as reliable in the literature for pain assessment[12].

In the present study it was observed that all the desensitising agents were successful in reducing the sensitivity of the patients. However clinpro XT varnish have not only shown a rapid reduction in sensitivity, but also shown a prolonged desensitizing action and patient satisfaction was highest in the short treatment period. It contains and releases Fluoride, calcium & phosphates thus forming an immediate layer of protection. G.C. Tooth Mousse was developed by Prof Reynolds at the University of Melbourne in 1998. It contains CPP and ACP. CPP stabilizes ACP and forms nano complexes with ACP at the tooth surface thereby providing a reservoir of calcium and phosphate ions which blocks the dentinal tubule.

Gluma Desensitizer contains hydroxy-ethyl-methacrylate (HEMA) with glutaraldehyde resulting in its desensitizing effect by precipitation of plasma proteins in the dentinal tubules which reduces dentinal permeability and occludes the peripheral tubules.

In the reaction of glutaraldehyde with dentin, the two groups of aldehydes present in glutaraldehyde interlace themselves with the amino groups of dentin collagen, leading to a fixing of proteins, forming a barrier[13] .The positive results of Gluma Desensitizer presented in this study are in agreement with the results of similar studies carried out earlier [14,15].After 2 weeks the effectiveness of gluma was better than GC tooth mousse as repeated application of GC is required for its effectiveness. Thus stating that its treatment is short lived requiring a home based treatment too.

It was seen that Bifluoride 12 was the least effective in the treatment period .It has been postulated that in contact with the mineralized structures, the fluoridated substances react chemically with the calcium and phosphate ions providing a precipitation of CaF2 crystals. Because it is an unstable compound, CaF2 rapidly dissociates after application, so that the anti-hyperesthesia effect is of short duration[13]. In spite of fluoride being recognized as an effective anti-caries agent, its use as a desensitizing agent is still reported as unsuccessful when compared to therapeutic agents such as Clinpro ,GC tooth mousse & Gluma, despite its distinct modes of action.

Conclusion

It can be concluded that all four agents, i.e. Clinpro XT, Gluma, Bifluoride 12 & G.C. tooth mousse effectively reduced dentin hypersensitivity. However clinpro XT have a more lasting desensitizing effect when compared to other agents. Bifluoride 12 showed the least effectiveness. It was also found that multiple applications were required for G.C. Tooth Mousse in reducing sensitivity as its effect reduced over time. Successful management of dentin hypersensitivity requires more research into factors such as diet, lifestyle and salivary flow/content. Correcting the factors which have led to sensitivity in the first place alone can prevent recurrence. It is desirable to develop novel agents that are capable of more effective and lasting tubule occlusion such as methods that mimic or harness the natural defence reactions of the dentin-pulp complex.

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