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RESEARCH ARTICLE

COMPARATIVE EVALUATION OF EFFICACY AND DURABILITY OF SELF-CURE AND LIGHT-CURE DESENSITIZING AGENTS IN THE TREATMENT OF DENTIN HYPERSENSITIVITY- AN IN-VIVO STUDY

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Abstract

Objectives: This in vivo study aimed to compare the efficacy and durability of three different varnishes/Desensitizing agents. Fluoride varnish, self-cure varnish, and light-cure varnish were used to treat dentin hypersensitivity by blocking dentinal tubules.

Materials and Methods: A total of 60 patients were randomly assigned into three groups; Group A: received desensitizing fluoride varnish (ProfluoridVarnish, Voco), Group B: received self-cure varnish (Systemp desensitizer, IvoclarVivadent) and Group C: received light-cure varnish (Admira Protect, Voco). Assessment of air and tactile sensitivity was done based on visual analogue scale scores at baseline, immediately after treatment, and one-monthpost-treatment. One-way ANOVA was used to assess the level of significance.

Results: The results showed there was no statistically significant difference in the VAS scores for tactile and evaporative stimuli between the three groups immediately after treatment. Group C – Admira Protect showed lesser mean VAS scores for both the stimuli immediately and after 30 days of application which was statistically significant with post hoc correction.

Conclusion: All three varnishes were effective in treating DH immediately after a single application. Profluorid Varnish showed lessefficacy when compared to resin varnishes at the end of one month. Clinical effectiveness was less at the end of one month for Systemp desensitizer, a self-cure varnish when compared to Admira Protect a light cure varnish.

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Introduction:-

Dentin Hypersensitivity (DH) is a short sharp pain caused by exposed dentinal tubules in response to thermal, tactile, osmotic, chemical or evaporative stimuli that cannot be explained by any other disease (Brännström& Åström1964).It is an unpleasant condition frequently observed in dental patients between the ages of 20 and 50. Clinical symptoms include gingival recession, attrition, abrasion, erosion, and traumatic loss of tooth structure (Burwell et al.,2010).DH affects 47% of the general population and is primarily seen in periodontal patients (Rees & Addy 2002).It frequently affects the buccogingival regions of canines, premolars, and regions that are vulnerable to gingival recession (Dababneh et al.,1999).Some patients experiencedDH as a side effect of tooth bleaching (Miglani et al., 2010).Most scientists now agree that dentin hypersensitivity results from the hydrodynamic fluid shift that happens across exposed dentinal tubules, as proposed by (Brännström&Åström, A 1964). All current treatment techniques address the two primary therapy choices for treating DH. The first option is plugging the open dentinal tubules to prevent fluid flow (Samuel et al., 2015). The second choice is to desensitize the nerve, making it less responsive to stimulation(Pashley et al 2008).

First-line treatment for DH is to advise regular use of desensitizing toothpaste for few weeks. Self-use desensitizing agents (DA) have the benefit of being instantly available, but their main drawback is that they take longer time to produce symptomatic relief—possibly two weeks to a month, and occasionally even three months. Though it is not a permanent solution, it provides temporary relief (Gillam et al., 1997).Professional methods of closing the open dentinal tubules should be taken into consideration if self-use prescriptions are unsuccessful, as they offer quick relief from DH symptoms (Braennstroem et al.).HEMA-G, Potassium oxyalate, Potassium nitrate, Sodium fluoride, Fluoride iontophoresis, and Lasers are examples of in-office treatment used to seal open dentinal tubules (Ikemura 1993, Wichgers&Emert et al., 1997, Moritz A et al., 1998).

Different forms of varnishes are availableto treat DH. Although all forms of clinically applied varnishes were effective in treating DH, the reported outcomes differed (Pashley et al., 2008, Wichgers&Emert 1997). Dental practitioners should be aware of how long the effect of in-office desensitizer lasts because patients who seek professional therapy for DH should be informed about the effectiveness and number of visits needed as the results of the treatment are transient. The effectiveness of self-cure and light-cure varnishes in reducing the symptoms of DH has only been the subject of a relatively small number of research.

Hence, this in-vivo study wasconducted to do a comparative evaluation of the efficacy and durability of three different varnishes – fluoride varnish, self-cure, and light-curevarnishes in treating DH.

Materials and Method:-

In this randomized clinical experiment, the sensitivity ratings were evaluated at the baseline, immediately after application and one month following the application of three different desensitivarnishes. Study subjects were made aware of the treatment protocol, and each patient's verbal and written consent was obtained in their native language. Ethical clearance was obtained from the ethical committee of Private Dental College and Hospital.Based on the following inclusion and exclusion criteria, 60 adult patients (28 females and 32 males) between the ages of 21 and 50 with sensitive teeth and a clinical diagnosis of DH were included in the study.

Inclusion criteria

1. Cooperative Patients with chief complaints of DH.
2. Teeth with small or no occlusal restorations.
3. Subjects willing to take part in the study for one month.

Exclusion criteria

1. Noncooperative patients.
2. Tooth sensitivity due to faulty restoration, dental caries, cracks, fracture, abfraction, or deep abrasion requiring restoration.
3. Patients who have undergone surgical or nonsurgical periodontal therapy within theprevious three months.
4. Pregnant women, lactating mothers, immune-compromised individuals, and patients with a history of allergy to any of the components of the study materials.

The patients were randomly assigned into three treatment groups; Group A: Patients treated with desensitizing fluoride varnish (Profluorid Varnish, Voco, Cuxhaven, Getrmany), Group B: Patients treated with self-cure varnish (Systemp desensitizer, IvoclarVivadent, Schaan, Liechtenstein), Group C: Patients treated with light-cure varnish (Admira Protect, Voco, Cuxhaven, Getrmany).

Assessment of hypersensitivity

Patients were subjected to tactile stimuli with dental explorer (# 17/23) passing at a right angle to the bucco-cervical tooth surface of concern andevaporative stimulation with air was provided by a three-way syringe from a dental unit at 40-65 psi. To assess the clinical efficiency of each desensitizer/varnish, responses were measured using a 10-cm visual analogue scale (VAS). A score of 0 was considered as being pain-free, while a score of 10 indicated severe discomfort symptoms.

Statistical Analysis

The data was compiled systematically in a Microsoft Excel Sheet and subjected to statistical analyses. Comparison of VAS scores of subjects were done through One way ANOVA test. Post hoc Bonferroni was used for pairwise comparison between the groups.

Results:-

There was no statistical difference in the VAS scores for tactile and evaporative stimuli between the three groups on day 1. Group C showed lesser mean VAS scores for mechanical and evaporative stimulus immediately and after 30 days of application of desensitizing agent which was statistically significant with post hoc correction.

Discussion:-

DH is an enigma that is frequently encountered (Johnsonet al., 1982). The ultimate objective is to have rapid relief that lasts longer. The desensitizing agents utilized in this study work by occluding the dentinal tubules at the surface and subsurface level to decrease permeability, therefore counteracting the hydrodynamic mechanism of DH. Sensitivity was recorded using a dental probe for the tactile method and one-second air blast for the evaporative method from a three-way syringe at 40-65 Psi at 1-3mm away and perpendicular to the exposed dentin using VAS. Due to dentin compression, the tactile approach results in the movement of the dentinal fluid (Pashley1986, Camps& Pashley 2003).Air blast can cause the dentin fluid to evaporate by lowering the temperature of exposed dentin.The movement of dentinal fluid from open dentinal tubules is caused by both effects(Krauser1986, Brahmbhattet al., 2012).Because VAS is the most suitable sensitivity assessment technique and has the advantage of converting subjective input into objective data, it was utilized to evaluate DH both before and after therapy (Pamir et al., 2007).

A colophony-based varnish with 5% sodium fluoride (22,600 ppm fluoride), Profluorid Varnish is simple to use and reasonably priced. Due to the colophony matrix, it binds well to wet tooth surface, inducing precipitation of calcium fluoride which effectively seals open tubules, reduces dentin permeability and DH (Samuel et al., 2014). By formation offluorapatite, fluoride varnish can have an instant desensitizing impact (He et al., 2011, Porto et al., 2009).

The Systemp desensitizer, a self-cure desensitizing varnish occludes the dentinal tubules by protein precipitation. Manufacturers claim polyethylene glycol dimethacrylate (PEG-DMA) present in Systemp triggers the precipitation of plasma proteins within tubules and glutaraldehyde acts as a cross-linking agent that binds to amine group of proteins. (Yu et al., 2010). According to Duran et al., it is fair to infer that the reaction between glutaraldehyde and the serum proteins in the tubule fluid causes plasma protein to coagulate, occluding the tubules and decreasing permeability (Duran et al., 2005).

Admira Protect, a light-cure Ormocer based desensitizing varnish is completely biocompatible, easy and quick to apply, thanks to a unique filler technology and fluoride release (Shetty et al., 2010). By occluding dentinal tubules and causing plasma proteins to precipitate inside the tubules, it greatly lowers dentin permeability and DH. Ormocers containing inorganic–organic copolymers with inorganic silanated filler particles present in it, bonds to dentin similar to self-etching adhesives (Dixit 2021, Pereira 2002) and enhances the wear resistance thereby resisting its removal. (Torres et al., 2014).

When compared to baseline mean VAS scores for tactile and evaporative stimuli, all of the DA in the current investigation showed a significant reduction in DH both immediately following application and at one-month intervals (table1 &2). Additionally, none of the experimental groups showed any discernible differences immediately following treatment (table 3). This is because all groups rapidly seal open dentinal tubules. While intra-group comparison showed significant reduction in the mean VAS scores 30 days post application of the DA indicating reduction of DH within all the three groups (table 4 & 5).After one month, there was a significant difference in the VAS scores across the groups, whereingroup C showing increased efficiency in the reduction of DH comparatively (table 6). This is explained by the type of adhesion, solubility of the precipitate or resin, wear resistance or dissolution resistance, and abrasion resistance of the DA employed (Torres et al., 2014).In comparison to Admira protect and PRG-barrier, Ravishankar, et al. discovered that Pro fluoride varnish was least effective in lowering DH at the end of one month (Ravishankar et al., 2018).This was consistent with our research since Profluorid varnish first showed signs of desensitization, but after a month, its effectiveness was noticeably lower than that of Admira Protect and Systemp desensitizer. This can be explained by their low adherence, which can be easily removed by saliva and toothbrush abrasion (Hsu et al., 2006).Both self-cure and light cure desensitizers were effective in the current study in lowering DH, however, the latter's effectiveness was comparably better. According to a study by Dundar et al., who assessed the permeability of five desensitizers using the computerized fluid filtration (CFF) test method. Seal & protect and Admira protect covered the dentin surface with maximumoccluding effect but systemp desensitizer occluded most of the dentin but the SEM images revealed few open dentinal tubules. (Dundar et al., 2015).

Admira Protect penetrates into the tubules creating resin tags and bonds to the dentin surface thereby sealing the tubules and reducing fluid flow. The Special filler particles resistance to abrasive forces prevents its removal by tooth brushingproviding extended duration of action when compared to Systempdesensitizer. Although dentin permeability was reduced, it could not seal permanently because of lack of homogeneous layer, which is crucial for an effective seal because any unsealed areas willenable water to penetrate.(Dundar et al., 2015). Hence repeated application of DA was required to alleviate DH symptoms on recurrence.

Table 1:- Comparison of vas scores of subjects at day 1, after immediate application of desensitizing agent and at day 30 after receiving Mechanical stimulus using ANOVA.

Timeline	Groups	Min	Max	Mean	Std. deviation	P value
At day1	Group A	2	4	3.00	0.795	0.46
	Group B	2	4	2.85	0.813	
	Group C	2	4	2.70	0.657	
After immediate application of desensitizing agent	Group A	0	4	2.55	0.999	0.00*
	Group B	0	3	1.95	0.887	
	Group C	0	2	0.90	0.553	
At day 30	Group A	1	3	2.20	0.616	0.00*
	Group B	1	2	1.45	0.510	
	Group C	0	1	0.25	0.444	

* Statistically significant

Table 2:- Comparison of vas scores of subjects at day 1, after immediate application of desensitizing agent and at day 30 after receiving Evaporative stimulus using ANOVA.

Timeline	Groups	Min	Max	Mean	Std. deviation	P value
At day 1	Group A	2	5	3.80	1.005	0.39
	Group B	2	5	3.40	1.046	
	Group C	2	5	3.55	0.686	
After immediate application of desensitizing agent	Group A	2	5	3.80	1.005	0.00*
	Group B	1	3	2.25	0.716	
	Group C	1	2	1.10	0.308	
At day 30	Group A	2	4	2.70	0.657	0.00*

	Group B	1	3	2.05	0.394	
	Group C	0	1	0.70	0.470	

* Statistically significant

Table 3:- Post hoc Bonferroni applied for pairwise comparison between the groups.

		Group A v/s Group B		Group A v/s Group C		Group B v/s Group C	
		Mean difference	P value	Mean difference	P value	Mean difference	P value
Day 1	Mechanical	0.15	1.00	0.30	0.64	0.15	1.00
	Evaporative	0.40	0.53	0.25	1.00	-0.15	1.00
Immediately	Mechanical	0.60	0.08	1.65	0.00*	1.05	0.001*
	Evaporative	1.55	0.00*	2.70	0.00*	1.15	0.00*
Day 30	Mechanical	0.75	0.00*	1.95	0.00*	1.20	0.00*
	Evaporative	0.65	0.001*	2.00	0.00*	1.35	0.00*

* Statistically significant

Table 4:- Comparison of VAS scores of subjects receiving mechanical stimulus of different groups within different time intervals using repeated measures ANOVA.

Groups	Timeline	Min	Max	Mean	Std. deviation	P value
Group A	Day 1	2	4	3.00	0.795	0.00*
	Immediately	0	4	2.55	0.999	
	Day 30	1	3	2.20	0.616	
Group B	Day 1	2	4	2.85	0.813	0.00*
	Immediately	0	3	1.95	0.887	
	Day 30	1	2	1.45	0.510	
Group C	Day 1	2	4	2.70	0.657	0.00*
	Immediately	0	2	0.90	0.553	
	Day 30	0	1	0.25	0.444	

* Statistically significant

Table 5:- Comparison of VAS scores of subjects receiving evaporative stimulus of different groups within different time intervals using repeated measures ANOVA.

Groups	Timeline	Min	Max	Mean	Std. deviation	P value
Group A	Day 1	2	5	3.80	1.005	0.00*
	Immediately	2	5	3.80	1.005	
	Day 30	2	4	2.70	0.657	
Group B	Day 1	2	5	3.40	1.046	0.00*
	Immediately	1	3	2.25	0.716	
	Day 30	1	3	2.05	0.394	
Group C	Day 1	2	5	3.55	0.686	0.00*
	Immediately	1	2	1.10	0.308	
	Day 30	0	1	0.70	0.470	

* Statistically significant

Table 6:- Post hoc Bonferroni applied for pairwise comparison between the groups.

		Day 1 v/s Immediate		Day 1 v/s Dy 30		Immediate v/s Day 30	
		Mean difference	P value	Mean difference	P value	Mean difference	P value
Group A	Mechanical	0.45	0.01*	0.80	0.00*	0.35	0.20
	Evaporative	0.00	-	1.10	0.00*	1.10	0.00*
Group B	Mechanical	0.90	0.00*	1.40	0.00*	0.50	0.013*
	Evaporative	1.15	0.00*	1.35	0.00*	0.20	0.64

Group C	Mechanical	1.80	0.00*	2.45	0.00*	0.65	0.00*
	Evaporative	2.45	0.00*	2.85	0.00*	0.40	0.006*

* Statistically significant

Conclusion:-

All three varnishes were effective in treating DH immediately after application. Profluorid varnish showed less efficacy when compared to resin varnishesat the end of one month,light-cure varnish Admira Protectwas more efficient when compared to self-cure varnish Systempdesensitizer.More in-vivo studies are required to evaluate the same for a longer duration.

Clinical Significance

Dental practitioners should be aware of the efficacy of desensitizers used in the clinical practice as the people seeking professional treatment for DH should be informed about the durability and the frequency of visits required by the patient, since the outcome of the treatment is temporary.

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