



Research Article

COMPARISON OF THREE DIFFERENT TREATMENT MODALITIES FOR DENTINAL HYPERSENSITIVITY

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ARTICLE INFO

Article History:

Received 13th February, 2021

Received in revised form 11th March, 2021

Accepted 8th April, 2021

Published online 28th May, 2021

Key words:

APF gel iontophoresis, dentin bonding agent, dentinal hypersensitivity, sodium fluoride varnish

ABSTRACT

Background: Dentinal hypersensitivity is one of the most common painful conditions to visit dental clinic. Identification of the etiological factor and management of the same is of prime concern. Till date no universally accepted treatment modality is available. Thus the aim of the present study is to evaluate and compare the efficiency of sodium fluoride varnish, dentin bonding agent and acidulated phosphate fluoride (APF) gel iontophoresis in treating dentinal hypersensitivity.

Materials and Methods: Eighteen individuals with 92 teeth diagnosed with hypersensitivity were selected. Patients with VAS score of ≥ 5 on application of tactile or air-blast stimuli were included. The desensitizing agents used were Sodium fluoride varnish, dentin bonding agent and APF gel Iontophoresis. The teeth were evaluated immediately after treatment and at 1, 2 and 4 week recall interval.

Results: The results were statistically analyzed using Repeated measures ANOVA and One way ANOVA test. There was a significant decrease in the mean VAS scores from baseline to 4 week in all groups.

Conclusions: All three agents showed statistically significant reduction in sensitivity compared with baseline. However, APF gel iontophoresis showed immediate as well as sustained desensitizing effect at all time intervals with lesser need of retreatment.

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INTRODUCTION

Dentinal hypersensitivity of teeth is one of the most common complaints to seek dental treatment due to pain, discomfort and loss of function. Dentin hypersensitivity (DH) can be defined as a short, sharp pain arising from exposed dentin in response to stimuli typically thermal, evaporative, tactile, osmotic, or chemical which cannot be ascribed to any other form of dental defect or pathology (AAP, GPT 1992). It comprise of multifactorial etiology like attrition, abrasion, erosion, abfraction, gingival recession etc. Identification and treatment of the cause of DH is often a challenge as there is no gold standard treatment accepted universally. Hydrodynamic theory proposed by Brannstrom *et al* (1964) is the most accepted theory. According to this theory, fluid movement occurs in the dentinal tubules in response to external stimuli stimulating the pulpal nerve ends causing pain.

Thus the treatment of DH includes either suppression of the nerve impulse by direct neurological interaction or mechanical blockage of the tubules.

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A potent in office desensitizing agent is used when DH is localized to few teeth or when home medications fail. Potassium salts are most common nervous modifiers which act by depolarizing the cells and provide instant relief (Miglani S, 2010). Tubular occlusion can be either by chemicals like fluorides, oxalates, arginine or physical blockage by adhesives, lasers, iontophoresis. These different modalities have shown varied results over time.

Hence the aim of this study was to evaluate and compare the efficiency of sodium fluoride varnish, dentin bonding agent and acidulated phosphate fluoride (APF) gel iontophoresis in treating dentinal hypersensitivity.

MATERIALS AND METHODS

This randomized control trial for comparison of three treatment modalities namely, sodium fluoride varnish, dentin bonding agent and APF gel iontophoresis was conducted in Department of Periodontology, Government Dental College & Hospital Nagpur, India.

Study Cohort

Patients who presented with complaint of dentin hypersensitivity were considered. Eighteen patients of both

sexes and age 18 years and above, having atleast two teeth demonstrating hypersensitivity on buccal surface to heat, cold or mechanical stimuli were selected. Patients exhibiting pain score of five or more on the Visual Analog Scale (VAS) were included. Exclusion criteria included history of current desensitizing therapy, teeth with fracture, cracks, untreated caries, large restorations, gross oral pathology, advanced periodontal disease, teeth whitening in past 3 months, non vital teeth, teeth with pulpal pathology, chronic systemic disease, pregnant and lactating mothers. Written and verbal informed consents were obtained from all the patients. The study was conducted in accordance with the Declaration of Helsinki guidelines.

Study design

Randomized control clinical trial study design was adopted. Individuals were randomly assigned to one of the three study groups based on software. Before the hypersensitivity treatment, phase I therapy was completed. Numerical 0-10 VAS scale was used to assess the sensitivity/pain response with 0 indicating ‘no pain’ and 10 indicating ‘intolerably severe pain’. After application of test stimuli at baseline the teeth having 5 or more rating on VAS scale were selected. Teeth to be treated were cleaned with pumice slurry and isolated with the cotton rolls and air dried. Drugs were randomly applied. Post treatment VAS response was evaluated at 0 day- immediately after treatment, after 1 week, 2 week and 4 weeks.

Test stimuli

Tactile test: A sharp dental explorer was gently passed over the affected surface of the tooth, perpendicular to the long axis. **Air blast test:** A blast of air at a distance of 1 cm with 45-60 psi from a three way dental syringe was applied for 1 second. The test stimulus was immediately removed, if the discomfort was intolerable by the patient. Both the test stimuli were applied with a minimum 5 min interval.

Treatment groups

Study group A: Sodium fluoride varnish (Fluoritop SR, ICPA Health Products Ltd, Mumbai). Tooth was isolated by cotton rolls, dried, and a thin layer of Varnish was applied with applicator tip. A gentle stream of air was applied to dry the varnish and spread it evenly for atleast 5 minutes. Patient was asked to avoid eating, drinking, smoking for atleast 30 mins after application.

Study group B: Dentin bonding agent (Kerr, OptiBond All-In-One, USA). The tooth was isolated, dried and a thin layer of DBA was applied over the surface and light cured for 20 seconds.

Study group C: APF gel Iontophoresis (Digital Iontophoresis, Krupa Medi Scan, Ahmedabad). The tooth was isolated, dried and a thin layer of 1.23% APF gel (Fluorovil, Vishal Dentocare, Ahmedabad) was applied with applicator tip. The patient was asked to hold the other end of the handle to complete circuit of iontophoresis unit. A progressively increasing current was applied, a maximum of 0.5mA, and this current was applied for 2 minutes per tooth, comprising a dosage of 1mA per minute.

Teeth were evaluated immediately after treatment, after 1 week, 2 week and 4 weeks. In case of recurrence in the

hypersensitivity at recall visits, the affected teeth were retreated.

Statistical analysis

SPSS version 16 (Version-2008) was used for analysis. Data obtained was compiled in MS Office Excel sheet. Descriptive statistics like mean and standard deviation were depicted. Repeated measures ANOVA test was used for within group comparison of the mean VAS scores (Table 1,2,3).

Table 1 Intragroup comparison between Mean VAS score at baseline and different treatment interval in Group A by Repeated measures ANOVA test

Mean VAS score	Mean VAS score	p value
Baseline 6.167 ±1.472	Immediate after treatment 2.833 ± 0.983	.089
	1 week 2.5 ± 1.643	.088
	2 week 1.5 ± 1.225	.017
	4 week 1.333 ± 1.211	.010

p<0.05 is statistically significant

Table 2 Intragroup comparison between Mean VAS score at baseline and different treatment interval in Group B by Repeated measures ANOVA test

Mean VAS score	Mean VAS score	p value
Baseline 5.833 ± 0.983	Immediate after treatment 3 ± 0.894	.019
	1 week 2.833 ± 0.753	.004
	2 week 2.167 ± 0.983	.000
	4 week 2 ± 0.894	.000

p<0.05 is statistically significant

Table 3 Intragroup comparison between Mean VAS score at baseline and different treatment interval in Group C by Repeated measures ANOVA test

Mean VAS score	Mean VAS score	p value
Baseline 5.833 ± 0.983	Immediate after treatment 2.833 ± 1.722	.144
	1 week 2.333 ± 1.506	.046
	2 week 2.167 ± 1.329	.019
	4 week 1.833 ± 0.983	.006

p<0.05 is statistically significant

Intergroup comparison was done by One way ANOVA test (Table 4). p<0.05 was considered statistically significant. All the observations and results were tabulated and graphically represented after statistical analysis.

Table 4 Intergroup Comparison between 3 groups by One way ANOVA test

Treatment interval	Group	N	Mean	Std. Deviation	p value (ANOVA)	Post-Hoc Test	
						Groups	P value
baseline	A	6	6.1667	1.47196	0.85	A vs B	.875
	B	6	5.8333	.98319		A vs C	.875
	C	6	5.8333	.98319		B vs C	1.0
	Total	18	5.9444	1.10997			
immediate	A	6	2.8333	.98319	0.96	A vs B	.971
	B	6	3.0000	.89443		A vs C	1.000
	C	6	2.8333	1.72240		B vs C	0.971

	Total	18	2.8889	1.18266			
Week 1	A	6	2.5000	1.64317	0.81	A vs B	.906
	B	6	2.8333	.75277		A vs C	.975
	C	6	2.3333	1.50555		B vs C	0.802
	Total	18	2.5556	1.29352			
Week 2	A	6	1.5000	1.22474	0.54	A vs B	.605
	B	6	2.1667	.98319		A vs C	.605
	C	6	2.1667	1.32916		B vs C	1.00
	Total	18	1.9444	1.16175			
Week 4	A	6	1.3333	1.21106	0.52	A vs B	.521
	B	6	2.0000	.89443		A vs C	.688
	C	6	1.8333	.98319		B vs C	0.958
	Total	18	1.7222	1.01782			

RESULTS

A total of 92 teeth in 18 patients were treated aged between 21 to 56 years. All the three groups showed statistically significant reduction in the mean VAS score at the end of one month ($p < 0.05$). However in group C i.e APF gel iontophoresis there was significant decrease in the mean VAS score immediately after the treatment, whereas significant difference was seen in Group B (Dentin bonding agent group) after 1 week and Group A (Sodium fluoride varnish) after 2 weeks. Thus all the three groups had equivalent effect on reduction of hypersensitivity when followed upto 4 weeks. Although, on intergroup comparison among the three groups there was statistically non-significant difference at all time interval, thus all the three agents showing good short term relief from hypersensitivity. But on the followup visits, it was noted that all the patients (100%) in the Sodium fluoride varnish group required repeated application of the agent whereas in Dentin bonding agent group (40%) and APF gel iontophoresis group (15%), need for re-application of the agent was less.



Fig 1 Group A- Sodium fluoride varnish



Fig 2 Group B- Dentin bonding agent

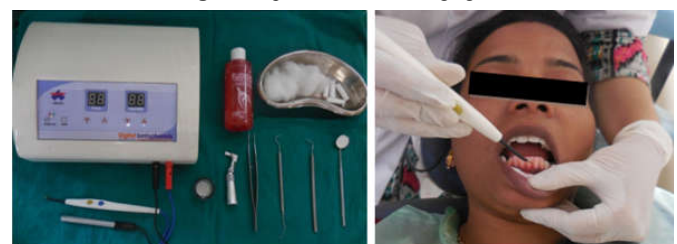


Fig 3 Group C- APF gel Iontophoresis



Fig 4 Test- Tactile & Airblast stimuli

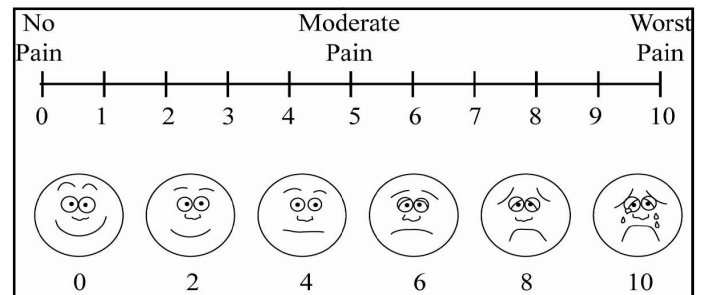


Fig 5 Visual Analog Scale (VAS)

DISCUSSION

Dental hypersensitivity is a painful condition that affects patient's quality of life by interfering with the daily activities like eating, drinking, teeth brushing and talking (Favaro Zeola L, 2019). The treatment of dental hypersensitivity causes the physical symptoms of pain to subside as well as increases psychological comfort and quality of life was concluded in a systematic review by Douglas-de-Oliveira *et al*(2018). There are numerous articles regarding different modalities and methodologies to treat DH. In the present study DH was evaluated by tactile and air blast evaporative stimuli, which are simple and reproducible.

For evaluation of DH, there are various tools like Visual Analog Scale (VAS), Numerical rating scale(NRS), Verbal rating Scale (VRS), Schiff Cold Air Sensitivity Scale (SCASS) etc. In the present study, Visual Analog scale was used. VAS consists of a straight line of 10 cm measuring 0-10cm with 'No pain' and 'Severe pain' on the extremities. Patient is asked to score the line according to the intensity of pain experienced. It is considered as an objective method of assessing pain & is the most widely used in the literature (Marto CM, 2019).

Treatment of DH involves accurate diagnosis of the etiology and removal of the cause. Despite tremendous research in the field, there is no gold standard treatment modality available both in terms of magnitude and duration of the desensitizing effect. Based on the concept of Brannstorm's Hydrodynamic theory(1964), occlusion of the dentinal tubules to prevent the flow of dentinal fluid is most widely used treatment.

The concept of Iontophoresis was first described by Pivati *et al* in 1747(Aparna S, 2010) and Leduc *et al* (1900) used iontophoresis for administering pharmacologic drugs(Singh J *et al* 1993). In 1960s, Iontophoresis was used in dentistry to treat Dental hypersensitivity. It can also be used in treatment of aphthous ulcer, lichen planus, herpes labialis(Gangarosa *et al* 1995). Iontophoresis uses a low amperage direct electrical current to introduce ions or ionized drugs into tissues for localised concentrated delivery. It is based on the principle of opposite charges attract while like charges repel. Thus the negative ions like Fluoride ions get attracted to the calcium present in the hydroxyapatite crystals forming calcium fluoride which blocks the dentinal tubules. Other theories include

formation of reparative dentin or paresthesia of the nerve on application of electric current (Gangarosa *et al* 1978). Nilam Brahmhatt *et al* (2012) found 2% NaF Iontophoresis was more effective in reducing hypersensitivity than 2% NaF local application, thus confirming increased penetration and occlusion of dentinal tubules by passage of electric current. McBride *et al* (1991) showed that iontophoretically treated teeth had twice fluoride concentration than locally applied. Sodium fluoride has to be freshly prepared each time for use. 1.23% APF gel used in the present study is available in gel form and when applied on tooth, forms calcium fluoride, fluorhydroxyapatite, and phosphate ions. Application of current results in interaction of the negative and positive ions, forming fluoride complexes which block the tubules.

Other agents used in the present study include dentin bonding agent and sodium fluoride varnish. The bonding agent used in the present study was Self etching adhesive which is a fifth generation DBA (Kerr, OptiBond All-In-One, USA). HEMA being water soluble aids in more penetration of the primer into the dentinal tubules, thus forming adhesive plugs on light curing (Aparna S *et al* 2010). Sodium fluoride varnish (Fluoritop SR) is an alcohol based varnish which permits slow release of fluoride and results in precipitation of Calcium fluoride crystals. However the effect of topical application is transient and incomplete.

All the three agents used in the present study showed significant reduction in the hypersensitivity at 4 weeks follow up. However, in Sodium fluoride varnish group, significant results were obtained after 2 weeks thus indicating more time required for precipitation of Calcium fluoride crystals resulting in reduction of radius of Dentinal tubules. This results are similar to findings seen by Tal *et al*(1976). During the follow up visits, all sites required reapplication of Sodium fluoride varnish whereas 40% sites in Dentin bonding agent group and 15% sites in the Iontophoresis group. Thus there was a clinical difference observed in between the groups with more sustained Desensitizing effect over a period of 4 weeks seen in the Iontophoresis group than the other two groups. Dilution of the calcium fluoride crystals in the presence of saliva as well as tooth brushing may be the reason of wearing off of the agents.

The limitations of study include short term evaluation with a smaller sample size. Subjective assessment of the response lacks standardization. More randomized controlled trials, with objective assessment having larger sample size and long term follow up are needed.

CONCLUSION

The results of our study showed significant reduction in the hypersensitivity assessed by VAS scores form baseline to 4 weeks in all the three groups. On intergroup comparison all the three agents i.e Sodium fluoride varnish, Dentin bonding agent and APF gel Iontophoresis were equally effective in reducing hypersensitivity over a period of 4 weeks.

Topical Sodium fluoride varnish application required more repeated applications at each recall visit than Dentin bonding agent and APF gel iontophoresis. APF gel iontophoresis showed immediate as well as sustained desensitizing effect at all time intervals with lesser need of retreatment. Further studies on larger sample size and for longer duration needs to be carried out.

Acknowledgements: None

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How to cite this article:

Vaishnavi R. Chodankar *et al* (2021) 'Comparison of Three Different Treatment Modalities for Dentinal Hypersensitivity', *International Journal of Current Advanced Research*, 10(05), pp. 24470-24473.
DOI: <http://dx.doi.org/10.24327/ijcar.2021.24473.4855>
