ORIGINAL ARTICLE

Clinical Evaluation between Sodium (self-cure) and Potassium (light-cure) Fluoride Varnish in the Management of Hypersensitive Dentine

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ABSTRACT

Objective: **To compare the clinical efficiency between the conventional sodium fluoride (self-cure) and potassium fluoride (light-cure) varnish in the treatment of hypersensitive dentin at different periods.**

Methodology: **100 patients were selected based on the inclusion and exclusion criteria. The subjects were randomly divided into two groups- G1 (control): Composeal varnish and G2 (experimental): Protect Light Seal varnish. The level of hypersensitivity of each volunteer was analyzed by the visual analog scale (VAS scale) at 5 minutes, 1 week, and 1-month intervals by using a blow of cold air from the three-way dental syringe. Non-parametric Kruskall-Wallis test and Wilcoxon Signed Rank test were done to compare the pain level scores and to detect the change of pain scores at different periods.**

Results: **Both desensitizers were able to reduce the pain scores significantly ($p < 0.001$) with time as there was no significant difference ($p = 0.991$) between them. Although, the potassium fluoride varnish was able to reduce the pain scores to a bearable level (i.e. below 2) within 1 week.**

Conclusion: **The light cure potassium fluoride varnish was able to reduce dentinal hypersensitivity to comfort level within 1week which then further reduced in 1 month.**

KEY WORDS

dentin hypersensitivity, dentine desensitizers, fluoride varnish, visual analog scale

INTRODUCTION

Dentin hypersensitivity is one of the most common painful incidents affecting oral health and function. It evokes a temporary sharp rise of pain or exaggeration when the exposed dentin is stimulated by thermal, chemical, evaporative, osmotic, or tactile stimuli. The prevalence of dentine hypersensitivity varies between 4 to 69% in the adult population, ages ranging from 20-40 years[1)]. Exposure of the root surface by the chronic trauma (e.g. toothbrushing, parafunctional habits, malocclusion), gingival recession, periodontal disease, or loss of enamel in the coronal portion by the abrasion, erosion, abfraction, or combination predisposing to dentin hypersensitivity[2)]. The hydrodynamic theory of dentinal fluid is considered the main reason for hypersensitivity[3)]. The fluid within the exposed dentinal tubules may move in either inward or outward direction based on the pressure difference in surrounding tissues. This fluid shifting activates the mechanoreceptors of nerves inside tubules or in the superficial pulp which is perceived by the patient as a sharp pain of rapid onset. Therefore, the treatment modalities that include sealing the dentinal tubules and thereby, restricting the fluid flow may prove effective in the management of hypersensitive dentine.

Available treatment options that facilitate blockage of dentinal tubules are- dentin bonding agents and derivatives, depolarizing agents, topical fluorides such as toothpaste, mouth rinse, varnish, and gel. The fluorides form calcium-phosphorus precipitates, calcium fluoride (CaF2), and fluorapatite that block fluid movement inside the dentinal tubule and thus reduce dentine sensitivity[4)]. Particularly, professional fluoride varnish treatment has been used successfully with significant and immediate pain relief lasting for weeks[5,6)]. This is because, the dental varnish can remain for hours on the tooth surface which allows its base to penetrate deep into dentinal tubules and release a high concentration of fluoride ions forming fluorapatite and CaF2 for a long time[7,8)]. In fluoride varnish various fluoride salts such as- sodium fluoride (NaF), calcium fluoride (CaF2), stannous fluoride (SnF2), titanium tetrafluoride (TiF4) are added[9)]. These water-soluble compounds readily provide free fluoride on exposure to the oral environment. Among these, fluoride varnish consisting of 5% Naf is most commonly used[10)]. Recently, dental varnish containing 1% potassium fluoride (PF) as an active ingredient has been introduced commercially (e.g. Protect Light Seal, Cercamed, Poland). It is also added with HEMA (Hydroxyethyl methacrylate) to facilitate light cure polymerization. Potassium ions can suppress nerve impulses by decreasing the excitability of A-fibers surrounding the odontoblasts which significantly reduces tooth sensitivity[2)]. In comparison to NAF, PF has higher solubility, is relatively free from

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Table 1: Pain improvement at different time intervals by the desensitizers.

Groups	Time Intervals	Pain improved	Pain not improved	Pain worsened
Compo-seal (50)	Pre-treatment to 5 minutes	38	12	0
	5minutes to 1 week	38	9	3
	1 week to 1 month	38	12	0
Coat-it (50)	Pre-treatment to 5 minutes	45	4	1
	5minutes to 1 week	48	2	0
	1 week to 1 month	22	28	0

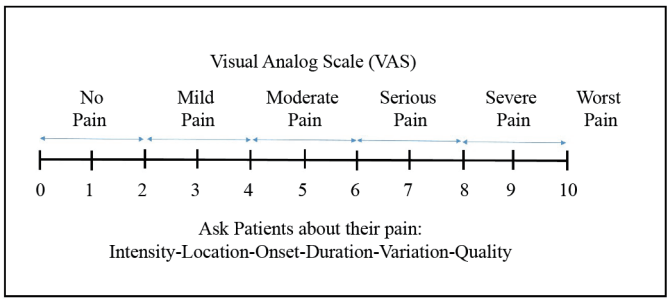

Figure 1: Pain determination by the visual analog scale (VAS).

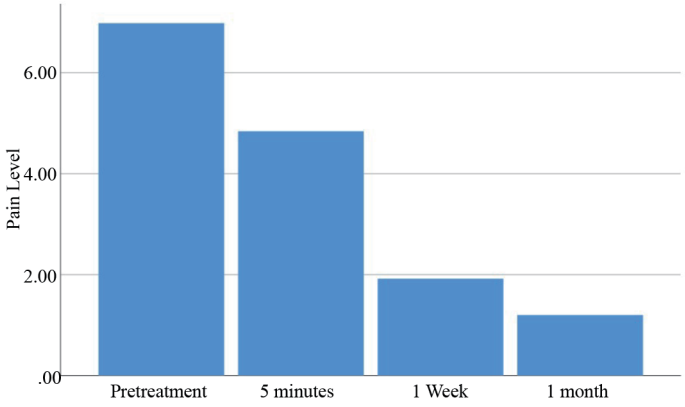

Figure 3: Dentine hypersensitivity management by Protect Light Seal.

ion association, and is used to provide higher fluoride concentrations in dental products like toothpaste, mouth rinses, and gels[11-14]. Therefore, the study aimed to clinically compare the effectiveness of the conventional self-cure 5% NaF varnish and light cure of 1% PF varnish in the management of hypersensitive dentin.

MATERIALS AND METHODS

This is a randomized longitudinal clinical study. One hundred (100) patients were selected from the outpatient department of a dental hospital. The selection was based on certain inclusion and exclusion criteria. For the eligibility, sensitive teeth exhibiting wear or gingival recession with exposure to cervical dentine were considered. Patients with irreversible pulpitis or pulp necrosis, carious lesions, defective restorations, cracked enamel, active periodontal disease, and use of daily doses of medications were excluded. Even the patients who had undergone professional desensitizing therapy for the last 3 months and women with a history of pregnancy and lactation were also excluded. A detailed oral and written informed consent was taken from all the participants. A detailed medical and dental history was recorded from all the participants along with a comprehensive dental check-up.

Table 2: Comparative mean pain scores in both desensitizer groups

Time Intervals	Mean Pain Scores	
	Composeal	Protect Light Seal
Pre-treatment	6.98 ± 0.79	6.98 ± 0.95
After 5 minutes	5 ± 1.55	4.84 1.69
After 1 week	2.98 ± 1.64	1.92 ± 1.63
After 1 month	1.4 ± 1.5	1.2 ± 1.45

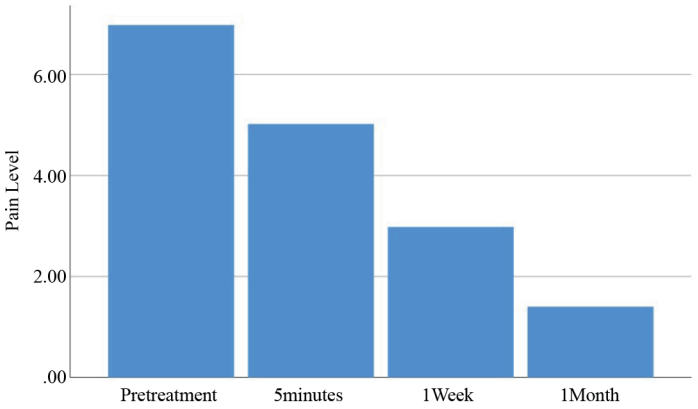

Figure 2: Dentine hypersensitivity management by Composeal.

All the lesions were located on the facial surface of the teeth. If the patient had multiple lesions in the same quadrant, only one of the lesions would receive the treatment, at that time. At the time of first screening, dietary counseling, oral hygiene instructions, and techniques with non-fluoride toothpaste were given. Finally, the patients were standardized and the lesions were randomly divided into two groups.

The severity of dentine hypersensitivity was measured by the visual analog scale (VAS) (Figure 1). Patients were asked to express their level of dentine hypersensitivity on a scale of 0 to 10, where 0 means "no pain" and 10 means "worst pain". The patients were asked about their dentine hypersensitivity level after a burst of air was applied to the lesion for 3secs by using a three-way dental syringe held 2mm away and perpendicular to the lesion. To exclude any false-positive results the adjacent teeth were isolated with cotton rolls. The experiment was done by a single operator in the same dental settings with similar air pressure. The first measurement was considered as a baseline (i.e. pre-treatment). Following the application of the dentine desensitizers, the level hypersensitivity was measured at 5 minutes, 1 week, and 1-month intervals by the same operator.

Group 1 (Composeal): At first the affected tooth is cleansed off plaque, calculus, or other debris, dried, and isolated with cotton rolls. 0.5 ml of Composeal varnish (Dentamerica, USA) was then applied to the lesion using a micro-brush. After that, the patient was instructed to wait for four minutes with an open mouth for allowing the varnish to set. The patients were then instructed according to the guidelines by the manufacturer.

Group 2 (Protect Light Seal): Following oral prophylaxis, the target tooth is dried and isolated with cotton rolls. A thin layer of Protect Light Seal (Cercamed, Poland) was applied to the lesion by a micro-brush and waited for 30 seconds. After that, it is light-cured using LED light-curing unit (Woodpecker, China) according to the manufacturer's instructions.

Statistical analysis: Data analysis was done using IBM SPSS software (version 25.0, Armonk, New York, USA). The level of significance was considered, $p < 0.05$. For comparison, the non-parametric Kruskal-Wallis test was done. Wilcoxon Signed Rank Test was done to investigate the change in pain scores from one-time point to another for both desensitizers.

RESULTS

At the pre-treat level, there was no significant difference ($p = 0.991$) in pain between the two assigned groups. Both desensitizers were able to reduce the pain significantly ($p < 0.001$) at different time intervals (Figures 1 and 2). Initially, after 5 minutes, no significant difference ($p = 0.513$) was observed between the desensitizers. After 1 week, Coat-it was able to reduce the pain significantly ($p = 0.001$) in comparison to Compo-seal. But again after 1 month, the efficacy of both desensitizers was similar ($p = 0.457$) in terms of relieving the pain. On post-hoc analysis, in 5 minutes following the application of composeal; 38 individuals reported pain relief and 12 individuals reported no improvement. Whereas in the group Protect Light Seal, 45 reported improvements, 4 reported no improvement, and only one reported worsening of pain (Table 1). Within 1 week, 48 individuals in Protect Light Seal group reported improvement with a mean level of pain below two (2) compared to the Composeal group where 38 individuals reported improvement but above level two (2). After 1 month, 48 individuals in compo-seal group reported pain improvement below level two.

DISCUSSION

The study clinically compared conventional NF and light cure PF varnish as no evidence of such comparison was found in the literature. The methods of eliminating hypersensitivity also differ between these agents. As the former occludes the dentinal tubules and the latter modifies the nerve impulse. Potassium changes the electric potential of cells by depolarization. Due to the depolarization, the nerve excitability decreases and the cells becomes less responsive to any stimuli[15]. In the present study, both mechanisms of action for reducing dentinal hypersensitivity seemed to be effective.

Dentin hypersensitivity is a clinical condition that adversely influences the individual's quality of life by interrupting daily activities like-talking, eating, drinking, tooth-brushing, etc.[16]. The pain sometimes becomes so severe that it leads to physical and emotional problems. In this study, the VAS scale pain was utilized for evaluating hypersensitivity. The scale consists of a straight line of 10 cm where the extremities are defined as "no pain" and "worst pain"[15]. It is considered an objective method to determine dentinal pain. It also allows to obtain quantitative results and thereby, is most widely used for assessing pain[17].

Dentin hypersensitivity can be evaluated by several methods- thermal, tactile, or evaporative stimuli. But in the study, only evaporative (e.g. burst of cold air from the dental air-water syringe) stimuli were applied. Because it involves the stimulation of a wider area of dentine, it is the most reproducible and physiologically controllable[18,19].

In this study, the maximum pain score obtained initially at the first visit was up to 9, which was labeled as "severe pain". At the pre-treatment level, patients in both groups reported similar pain scores (Table 2). After that, significant improvement in pain was observed in both groups from 5 minutes to a 1-month notice. Except that, PF desensitizer was able to reduce pain below the score of 2 within 1 week, which was denoted as between 'mild pain' and 'no pain'. Whereas, NF desensitizer-treated individuals reported an average pain score of almost 3 (Table 2) which was considered 'mild pain'. The addition of HEMA (Hydroxyethyl methacrylate) in PF varnish may also contribute to rapid relief from pain within 1 week. Upon polymerization, the HEMA forms deep tags of 200 µm which obliterates the dentinal tubules and thus reduces dentin hypersensitivity[20,21].

There is a wide variety of surface treatments available for dentin hypersensitivity. But still, there is no single treatment protocol that matches all of the ideal criteria. Hence, there is a lack of a gold standard for comparing new products. Presently, there is no desensitizing agent claiming superiority, and the choice of treatment is mainly dictated by the clinician's experiences and personal preferences[22].

According to Grossman, an ideal desensitizing agent would be easy to apply, painless, act rapidly, non-irritant to the pulp, not cause alteration in the tooth structure, and have a long-lasting action[23]. In the present study, there was neither any undesirable symptom in patients nor any adverse effect from the desensitizers used in both groups. This confirms that both desensitizers if properly applied- are safe and can produce predictable treatment outcomes.

Due to the lack of patient attendance, pain scores could not be monitored following 3 months and 6 months intervals which are considered the weakness of this clinical study. Had this been done, would have further strengthened the outcome of the study.

COMCLUSION

1. Despite different mechanisms of action, both desensitizers were able to reduce dentin hypersensitivity.
2. PF desensitizer with the advantage of HEMA reduced pain effectively (i.e. below score 2) within 1 week.
3. Due to the lack of co-operation from the patients, long-term follow-up (i.e. 3, 6 months) could not be performed which was inevitable.

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