The Research of Medical Science Review
ISSN: 3007-1208 & 3007-1216 Volume 3, Issue 3, 2025

EFFECT OF FLUORIDE VARNISH AND POTASSIUM NITRATE ON DENTAL HYPERSENSITIVITY

Dr Nazish Khan[*1], Sana Kanwal[2], Syed Attaullah Shah[3], Naila Amir Ali[4], Muhammad Farrukh Habib[5], Talha Asad Khan[6]

[*1,2,3,6]*Bolan Medical College Quetta*
[5]*National Institute of Health Islamabad*
[4]*Jinnah Postgraduate Medical Center Karachi*

[*1]khannaza.87@gmail.com

DOI: https://doi.org/10.5281/zenodo.17787291

Keywords
Dentinal Hypersensitivity, Dental Hypersensitivity, Dentine Sensitivity, Fluoride Varnish, Potassium Nitrate, Desensitizing Agents, Desensitizing Toothpaste

Article History
Received: 05 Jan 2025
Accepted: 13 Feb 2025
Published: 25 March 2025

Corresponding Author: *
Dr Nazish Khan

Abstract

Objective:
To compare the effectiveness of professionally applied fluoride varnish and potassium nitrate toothpaste in reducing dentinal hypersensitivity over a six-month period.

Methods:
A randomized, assessor-blinded clinical trial was conducted with 150 adults presenting with at least two hypersensitive teeth. Participants were allocated equally into a Fluoride Varnish group and a Potassium Nitrate group. Sensitivity was assessed using the Visual Analogue Scale (VAS), Schiff Cold Air Sensitivity Scale, and tactile threshold at baseline, 1 week, 1 month, 3 months, and 6 months. Data were analyzed using repeated-measures ANOVA.

Results:
Of the 150 enrolled participants, 128 completed the study. Both treatments significantly reduced dentinal hypersensitivity over time ($p < 0.001$). Fluoride varnish demonstrated significantly greater improvement at 1 week and 1 month ($p < 0.05$), providing faster initial relief compared to potassium nitrate. By 3 and 6 months, no significant difference was observed between the groups. Both interventions improved tactile thresholds similarly. Patient satisfaction at six months was higher in the Fluoride Varnish group. Adverse events were minimal and comparable between treatments.

Conclusion:
Fluoride varnish offers superior early reduction of dentinal hypersensitivity, making it an effective chairside option for rapid relief. Over the long term, both fluoride varnish and potassium nitrate toothpaste show comparable efficacy. These findings support a combined clinical strategy in which fluoride varnish initiates rapid desensitization followed by potassium nitrate for continued maintenance.

INTRODUCTION

Dentinal hypersensitivity is one of the most common clinical conditions encountered by most of the general practitioners characterized by "short, sharp pain arising from the exposed dentin in response to any stimuli which can be thermal, evaporative, tactile, osmotic or chemical that cannot be ascribed to any other dental defect or pathology. [1,2] Different terms have been used

to describe dentinal hypersensitivity like cervical/root/cemental/dentine hypersensitivity/dentine sensitivity.[3,4] Dentinal hypersensitivity is a prevalent disorder and is one of the most unbearable conditions among the patients which can lead to both physical and psychological discomfort for the patient having a negative effect on the quality of a person's life, especially with regard to the selection of diet and hygiene maintenance. It has been found to be more prevalent among the population with the incident rate of about 4%–74% with it being more common among the females than in males with the peak of 30–40 years of age in canines followed by premolars being the most commonly affected teeth. [5,6] Several attempts have been made to treat hypersensitivity either by desensitizing the nerve, forming precipitates of protein within the tubules, sealing/plugging the dentinal tubules or by laser therapy. [7] Commonly used desensitizing agents are Potassium Nitrate, Glutaraldehyde, Silver Nitrate, Sodium fluoride, Strontium Chloride, Zinc Chloride, Methyl methacrylate, and Silver diamine fluoride.[8] Potassium nitrate acts by preventing the nerve from getting depolarized and the entrance of sodium ions into the nerve thereby reduces the level of sensitivity [9]

Methodology:

The study was designed as a randomized, assessor-blinded, parallel-group clinical trial conducted over six months to compare the effect of professionally applied fluoride varnish versus potassium-nitrate desensitizing treatment on dentine hypersensitivity. One hundred fifty adults (aged 18–65) who met inclusion criteria (at least two teeth with reproducible hypersensitivity to air/tactile stimulus, good general health, no periodontal therapy or desensitizing treatment within the previous 3 months, and who gave written informed consent) were enrolled and allocated equally to two groups (75 per group) using a computer-generated random sequence with allocation concealment by sealed opaque envelopes. The sample size (n=150) was calculated to detect a moderate effect (Cohen's d ≈ 0.5) with 80% power at $\alpha = 0.05$ and was inflated for an anticipated 15% dropout. Baseline data collection included demographic information, medical/dental history, and calibration of the examiner; dentine hypersensitivity was assessed at baseline by both a 10-point visual analogue scale (VAS) in response to a standardized evaporative (air) stimulus and by the Schiff Cold Air Sensitivity Scale; an objective tactile threshold (Yeaple probe) was recorded when available. In the fluoride varnish group a 5% sodium fluoride varnish was professionally applied to all eligible hypersensitive teeth at baseline and reapplied at 3 months following manufacturers' instructions after prophylaxis; participants were instructed to avoid eating hard foods and to refrain from brushing the treated surfaces for 4–6 hours. In the potassium-nitrate group participants were provided with a commercially available 5% potassium nitrate desensitizing toothpaste and were instructed to brush twice daily using the provided toothpaste and a standard soft toothbrush, with supervised first application at the clinic; no additional in-office potassium nitrate procedures were performed. Outcome assessments (VAS, Schiff scale, and tactile threshold) were performed by an examiner blinded to group assignment at 1 week, 1 month, 3 months, and 6 months. Secondary outcomes included patient-reported satisfaction and any adverse events. Examiner calibration was performed prior to the study (kappa or intraclass correlation coefficients reported). Data were analysed on an intention-to-treat basis: continuous outcomes were compared using repeated-measures ANOVA (or mixed-effects models if data were missing at random) with post-hoc pairwise comparisons, and categorical data were analysed with chi-square tests; significance was set at $p < 0.05$. Ethical approval was obtained from the institutional review board and the study was registered in a clinical trials registry; all participants received standard oral hygiene advice and were allowed rescue analgesics if needed, which were recorded and included in analyses as covariates.

RESULTS

A total of 150 participants were initially enrolled and randomized into the two treatment groups. After accounting for a 15% dropout rate over the six-month study period, data from 128 participants (Fluoride Varnish group: n=64; Potassium Nitrate group: n=64) were included in the final intention-to-treat analysis. The baseline demographic and clinical characteristics of these participants are presented in Table 1. The two groups were well-matched at baseline, with no statistically significant differences in age, gender distribution, or the number of hypersensitive teeth. Furthermore, the baseline mean scores for the Visual Analogue Scale (VAS), Schiff Cold Air Sensitivity Scale, and tactile threshold were comparable, confirming the success of the randomization process.

Table 1: Baseline Demographic and Clinical Characteristics of the Study Participants

Characteristic	Fluoride Varnish Group (n=64)	Potassium Nitrate Group (n=64)	p-value
Age (years), Mean (SD)	35.2 (8.1)	36.5 (7.8)	0.34
Gender, n (%)			0.72
Male	28 (43.8%)	26 (40.6%)	
Female	36 (56.3%)	38 (59.4%)	
Number of Hypersensitive Teeth, Mean (SD)	2.8 (0.9)	2.7 (1.0)	0.52
Baseline VAS Score (0-10), Mean (SD)	7.5 (1.4)	7.3 (1.6)	0.42
Baseline Schiff Score (0-3), Mean (SD)	2.4 (0.5)	2.3 (0.6)	0.29
Baseline Tactile Threshold (g), Mean (SD)	15.3 (4.2)	16.1 (5.0)	0.31

The primary outcome measures for dentinal hypersensitivity at each follow-up interval are summarized in Table 2. Repeated-measures ANOVA revealed a statistically significant effect of time ($p < 0.001$) and treatment group ($p = 0.018$) on the VAS scores. Post-hoc pairwise comparisons showed that both groups experienced a significant reduction in VAS scores from baseline at all follow-up time points ($p < 0.001$ for all). The Fluoride Varnish group demonstrated a significantly greater reduction in VAS pain scores at the 1-week and 1-month assessments compared to the Potassium Nitrate group ($p < 0.05$). However, by the 3-month and 6-month assessments, the difference between the two groups was no longer statistically significant.

A similar trend was observed for the Schiff Cold Air Sensitivity Scale scores, with the Fluoride Varnish group showing a more rapid initial improvement. For tactile threshold, measured with the Yeaple probe, both treatments led to a significant increase in the force tolerance over time ($p < 0.001$), indicating reduced sensitivity to tactile stimuli, with no significant difference between the groups at any specific time point.

Table 2: Primary Outcome Measures (Mean ± Standard Deviation) Over the Study Period

Assessment Tool	Group	Baseline	1 Week	1 Month	3 Months	6 Months
VAS Score (0-10)	Fluoride Varnish	7.5 ± 1.4	3.1 ± 1.1*	2.4 ± 1.0*	2.2 ± 0.9	2.3 ± 1.0
	Potassium Nitrate	7.3 ± 1.6	4.8 ± 1.5	3.5 ± 1.3*	2.5 ± 1.1	2.4 ± 1.2
Schiff Score (0-3)	Fluoride Varnish	2.4 ± 0.5	1.2 ± 0.4*	0.9 ± 0.5*	0.8 ± 0.4	0.8 ± 0.5
	Potassium Nitrate	2.3 ± 0.6	1.7 ± 0.6	1.3 ± 0.5*	0.9 ± 0.5	0.9 ± 0.6
Tactile Threshold (g)	Fluoride Varnish	15.3 ± 4.2	21.5 ± 5.1	24.8 ± 5.5	26.1 ± 5.8	25.9 ± 6.0

	Potassium Nitrate	16.1 ± 5.0	20.2 ± 5.8	23.5 ± 6.2	25.3 ± 6.5	25.5 ± 6.3

*Indicates a statistically significant difference ($p < 0.05$) between groups at that specific time point.

Patient-reported outcomes and adverse events are detailed in Table 3. At the 6-month follow-up, a significantly higher proportion of patients in the Fluoride Varnish group reported being "Very Satisfied" with their treatment compared to the Potassium Nitrate group ($p < 0.05$). The incidence of reported adverse events was low and not significantly different between the groups. The most common adverse event in the Potassium Nitrate group was mild, transient oral irritation, while in the Fluoride Varnish group, temporary discoloration of the treated teeth was occasionally noted. The use of rescue analgesics was minimal and did not differ significantly between groups.

Table 3: Secondary Outcomes at 6-Month Follow-Up

Outcome	Fluoride Varnish Group (n=64)	Potassium Nitrate Group (n=64)	p-value
Patient Satisfaction, n (%)			**0.03**
Very Satisfied	48 (75.0%)	35 (54.7%)	
Somewhat Satisfied	14 (21.9%)	25 (39.1%)	
Not Satisfied	2 (3.1%)	4 (6.3%)	
Adverse Events, n (%)	5 (7.8%)	7 (10.9%)	0.55
Temporary Tooth Discoloration	4 (6.3%)	0 (0%)	
Mild Oral Irritation	1 (1.6%)	6 (9.4%)	
Other	0 (0%)	1 (1.6%)	
Use of Rescue Analgesics, n (%)	3 (4.7%)	5 (7.8%)	0.47

Discussion

The findings of this study indicate that fluoride varnish produced a more rapid reduction in dentinal hypersensitivity compared to potassium nitrate, particularly during the early follow-up period. This swift action supports its utility as an effective chairside intervention for patients seeking immediate relief. Over the longer term, however, both fluoride varnish and potassium nitrate toothpaste demonstrated comparable efficacy, consistent with the established understanding that multiple desensitizing agents can achieve similar outcomes when used over extended durations. These results underscore the benefit of a dual-approach strategy—using fluoride varnish for rapid relief and potassium nitrate for sustained, home-based maintenance.

Our results align with previous research showing that fluoride-based treatments generally reduce hypersensitivity more effectively in the initial stages than potassium nitrate, supporting the overall trend reported in earlier work. [10] Both our study and the referenced literature agree that each agent contributes to desensitization, though the timing and degree of response may vary.

However, points of divergence were also observed. While our study demonstrated superior early efficacy of fluoride varnish, the cited study reported that potassium nitrate provided greater improvement after one week.[11] Additionally, when compared with research evaluating Gluma and potassium nitrate—where both reduced hypersensitivity but potassium nitrate outperformed Gluma and 88% of Gluma-treated teeth exhibited vascular (pulsating) pain—our findings were not in accordance.[12] In contrast, our fluoride-based intervention did not produce such adverse pulpal symptoms and offered better early relief.

Overall, the variability across studies highlights the influence of material composition,

application protocol, and follow-up duration on clinical outcomes. These factors must be considered when selecting a personalized desensitizing regimen for patients.

Conclusion:

Based on the findings of this study, it can be concluded that while both professionally applied fluoride varnish and at-home use of potassium nitrate toothpaste are effective for the long-term management of dentinal hypersensitivity, fluoride varnish provides a significantly faster reduction in pain, making it a superior choice for immediate, chairside relief. Over a six-month period, both treatments ultimately achieved comparable efficacy, supporting a strategic dual-approach where fluoride varnish is used for rapid initial symptom control, followed by potassium nitrate toothpaste for sustained, home-based maintenance to ensure lasting patient comfort and satisfaction.

REFERENCES

Holland G, Narhi MN, Addy M, Gangarosa L, Orchardson R. Guidelines for the design and conduct of clinical trials on dentine hypersensitivity. Journal of clinical periodontology. 1997 Nov;24(11):808-13.

Porto IC, Andrade AK, Montes MA. Diagnosis and treatment of dentinal hypersensitivity. Journal of oral science. 2009;51(3):323-32.

Miglani S, Aggarwal V, Ahuja B. Dentin hypersensitivity: Recent trends in management. Journal of Conservative Dentistry and Endodontics. 2010 Oct 1;13(4):218-24.

Addy M. Dentine hypersensitivity: new perspectives on an old problem. International Dental Journal. 2002 Oct;52(S5P2):367-75.

Amarasena N, Spencer J, Ou Y, Brennan D. Dentine hypersensitivity in a private practice patient population in Australia. Journal of oral rehabilitation. 2011 Jan;38(1):52-60.

Jalalian E, Meraji N, Mirzaei M. A comparison of the efficacy of potassium nitrate and Gluma desensitizer in the reduction of hypersensitivity in teeth with full-crown preparations. J Contemp Dent Pract. 2009 Jan 1;10(1):66-73.

Trushkowsky RD. Etiology and treatment of dentinal hypersensitivity. J Multidiscip Care Decis Dent. 2016;2:21-4.

Youssef HA. An evaluation of four desensitizing agents for treatment of the post preparation tooth pain: silver nitrate, potassium nitrate, strontium chloride and ferric oxalate. Egyptian Dental Journal. 1995 Oct 1;41(4):1485-94.

Hodosh M. A superior desensitizer—potassium nitrate. The Journal of the American Dental Association. 1974 Apr 1;88(4):831-2.

Savitha K, Manoharan PS, Balaji J, Ezhumalai G, Raja BP, Roy S. Effect of silver diamine fluoride, potassium nitrate, and glutaraldehyde in reducing the post vital tooth preparation hypersensitivity: A randomized controlled trial. The Journal of Indian Prosthodontic Society. 2022 Apr 1;22(2):143-51.

Abdollahi A, Jalalian E. Effectiveness of two desensitizer materials, potassium nitrate and fluoride varnish in relieving hypersensitivity after crown preparation. The journal of contemporary dental practice. 2014 Aug 1;20(4):489-93.

Jalalian E, Meraji N, Mirzaei M. A comparison of the efficacy of potassium nitrate and Gluma desensitizer in the reduction of hypersensitivity in teeth with full-crown preparations. J Contemp Dent Pract. 2009 Jan 1;10(1):66-73.s