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Comparative Evaluation of Dentifrices Containing Pro-argin and Calcium Fluoro Phosphosilicate in Relieving Dentinal Hypersensitivity Post Non-Surgical Periodontal Therapy (NSPT)

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Abstract

Dentine hypersensitivity (DH) is a problem which affects 8% to 57% of the adult dentate population and peaks during the third and fourth decades of life. No single professionally applied desensitizing agent is superior to others in managing dentine hypersensitivity. The management of DH is being investigated with the remineralisation potential of agents in dentinal tubules. This study compared the efficacy of Pro-argin and Calcium fluorophosphosilicate on dentinal hypersensitivity post non-surgical periodontal therapy. A randomised, triple-blinded trial will be conducted with 34 participants clinically diagnosed with DH and equally randomized into two groups with parallel treatment assignment of Pro-argin and Calcium fluoro phosphosilicate based over the counter dentifrices and tested for DH with air blast, mechanical, and water jet stimuli on SCHIFF cold air sensitivity scale (SCASS)

and visual analogue scale (VAS) at interim efficacy intervals of 1, 2, 4, and 6-weeks subsequently. Both Pro-Argin and Calcium Fluorophosphosilicate dentifrices effectively reduced dentinal hypersensitivity following non-surgical periodontal therapy. However, the CFPS-based dentifrice demonstrated slightly superior long-term clinical outcomes.

Keywords: Dentinal hypersensitivity, Non-surgical periodontal therapy, Pro-argin, Calcium fluoro phosphosilicate.

Introduction

Dentinal hypersensitivity (DH) is a common clinical condition characterized by a short, sharp pain arising from exposed dentin in response to thermal, tactile, osmotic, or chemical stimuli. This pain cannot be attributed to any other dental pathology. DH significantly affects patients' oral health-related quality of life, causing discomfort during eating, drinking, brushing, and even breathing cold air[1].

The incidence of DH notably increases following non-surgical periodontal therapy (NSPT), such as scaling and root planing. These procedures, though essential for managing periodontal disease, can lead to the removal of cementum and exposure of dentinal tubules.[2] As a result, patients often report heightened sensitivity in the days and weeks following treatment, which may negatively impact compliance with oral hygiene instructions and long-term periodontal maintenance.[3]

The hydrodynamic theory, proposed by Brännström[4], suggests that fluid movement within the exposed dentinal tubules triggers nerve responses, leading to sensitivity. Therefore, desensitizing agents used in toothpaste formulations primarily aim to either occlude open dentinal tubules or to interrupt the neural transmission of pain[5]. Among the various active agents, Pro-Argin (a combination of arginine and calcium carbonate) and Calcium Fluorophosphosilicate (CFPS) have gained prominence due to their ability to promote tubule occlusion and remineralization.[6-8]

Pro-Argin functions by binding arginine and calcium carbonate to the dentin surface, forming a protective layer that occludes tubules.[9] CFPS, on the other hand, is a bioactive glass that releases calcium, phosphate, and fluoride ions, facilitating hydroxyapatite-like crystal formation and deeper, more stable occlusion.[10] Despite the availability of various agents, there is limited comparative clinical evidence evaluating their efficacy in the context of DH following NSPT.[11] This study aims to compare the clinical efficacy of dentifrices containing Pro-Argin and Calcium Fluorophosphosilicate in the management of dentinal hypersensitivity following non-surgical periodontal therapy.

Materials and methods

A randomized, triple-blinded, parallel-arm clinical trial included 34 participants clinically diagnosed with DH following non-surgical periodontal therapy. Participants aged 25 years or older with a Visual Analogue Score (VAS) greater than 4 in at least two teeth and diagnosed with Stage II-IV periodontitis (2017 classification) were included. Participants who had used desensitizing agents in the past three months, had pharmacological histories that could compromise the protocol (e.g., chronic use of anti-inflammatory or analgesic drugs), or had DH due to caries, defective restorations, fractures, or prosthetic appliances were excluded.

Participants were randomly divided into two groups: Group A received a Pro-Argin-based dentifrice, and Group B received a Calcium Fluorophosphosilicate-based dentifrice. All participants underwent standardized non-surgical periodontal therapy.

Figure 1:

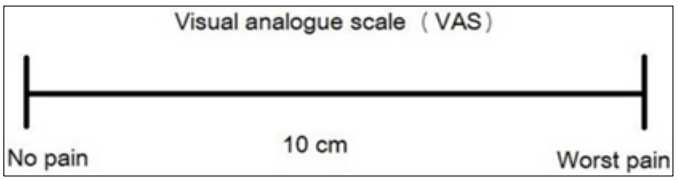

Figure 2:

Each subject received in-office application of 2g (Figure 1) of their assigned dentifrice to the hypersensitive teeth and were given a coded tube and toothbrush for at-home use. Instructions were provided to brush twice daily using the modified Bass technique for two minutes, rinse once with water and return the dentifrice tube at each follow-up visit (1, 2, 4, and 8 weeks) for weighing to assess compliance.

Pain was assessed using the Schiff Cold Air Sensitivity Scale (SCASS) and the Visual Analogue Scale (VAS). The Schiff Cold Air Sensitivity Scale (SCASS) is a subjective pain assessment tool widely used to evaluate dentinal hypersensitivity (DH) in response to air stimulus. It helps quantify a patient's reaction to evaporative stimulation (typically using a dental air syringe at 40–65 psi for 1 second from a distance of ~1 cm). Evaluations were conducted at baseline, immediately after application, and during all follow-up visits. Participants consistently scoring 3 on the SCASS were excluded for ethical reasons and received alternative treatment.

Results

Both groups showed a statistically significant reduction in dentinal hypersensitivity from baseline to all follow-up periods. Immediately after the in-office application, both Pro-Argin and CFPS demonstrated a noticeable decrease in SCASS and VAS scores. The mean immediate VAS reduction in the CFPS group was 1.2 ± 0.3, while it was 0.9 ± 0.4 in the Pro-Argin group.

At the 1-week follow-up, patients using CFPS reported a greater reduction in sensitivity with a mean SCASS score decrease of 1.6 ± 0.5 compared to 1.3 ± 0.6 in the Pro-Argin group. This difference, though modest, was statistically significant ($p=0.041$).

By the 2-week mark, VAS scores in the CFPS group averaged 2.1 ± 0.7, while the Pro-Argin group showed a mean of 2.5 ± 0.8, with SCASS scores also favoring CFPS ($p<0.05$). Patients reported improved comfort during brushing and consumption of hot/cold beverages.

At 4 weeks, 82% of patients in the CFPS group recorded VAS scores below 2, while only 65% of the Pro-Argin group achieved similar scores. SCASS scores in the CFPS group dropped to a mean of 0.8 ± 0.4, compared to 1.1 ± 0.5 in the Pro-Argin group. Participants also reported better subjective relief in the CFPS group.

By the 8-week follow-up, the CFPS group exhibited sustained desensitizing effects with a mean VAS score of 1.1 ± 0.5 and SCASS score of 0.5 ± 0.3. In contrast, the Pro-Argin group showed a slight rebound in symptoms, with a mean VAS of 1.6 ± 0.6 and SCASS of 0.8 ± 0.4. The intergroup difference at 8 weeks was statistically significant ($p=0.018$).

While both agents were effective, CFPS tended to provide more consistent relief across all time intervals, particularly in terms of onset and long-term symptom reduction.

Discussion

The present study demonstrates that both Pro-Argin and Calcium Sodium Phosphosilicate (CFPS)-based dentifrices effectively reduced dentinal hypersensitivity

(DH) following non-surgical periodontal therapy (NSPT). However, CFPS exhibited marginally greater clinical efficacy over the 8-week evaluation period. These findings are consistent with previous investigations[12,13] (Ashwini et al., 2018; Arshad et al., 2021), which have attributed the superior and sustained performance of CFPS to its bioactive properties and ability to promote hydroxyapatite-like mineral deposition within dentinal tubules.

CFPS, a bioactive glass composed of calcium, sodium, phosphorous, and silica, mimics the mineral phase of human dentin. Upon exposure to aqueous environments such as saliva, it rapidly releases calcium and phosphate ions, leading to the formation of a hydroxycarbonate apatite (HCA) layer. This biomimetic layer not only occludes dentinal tubules mechanically but also chemically bonds to the underlying dentin, promoting long-term desensitization[14,15] (Burwell et al., 2010; Gillam et al., 2011). Additionally, the continuous release of these ions serves as a sustained mineral reservoir, facilitating ongoing remineralization and reinforcing tubule occlusion over time[16] (Vano et al., 2015).

In contrast, Pro-Argin technology relies on the formation of an arginine-calcium carbonate complex, which occludes tubules by electrostatic binding to negatively charged dentin surfaces. While this mechanism has shown rapid initial relief[17,18] (Docimo et al., 2011; Cummins, 2010), our study supports previous findings indicating a decline in effectiveness over extended periods. Notably, beyond the first few weeks, patient-reported outcomes and clinician-observed sensitivity scores tended to favor the CFPS group, suggesting more durable clinical benefits.

The triple-blinded design of this trial, combined with the use of standardized protocols and validated indices such as the Schiff Cold Air Sensitivity Scale (SCASS), lends strength to the internal validity of these findings. Furthermore, efforts to mitigate patient compliance variability—such as detailed home-care instructions and blinded weighing of dentifrice tubes—enhanced the robustness of the data.

Nonetheless, certain limitations should be acknowledged. DH remains a subjective condition influenced by individual pain thresholds, and despite employing standardized stimuli, inter-individual variation in response remains a challenge. Additionally, reliance on patient-reported brushing compliance introduces an element of recall bias. Future studies may benefit from integrating objective brushing monitors or longer follow-up periods to assess the stability of treatment effects over several months.

Conclusion

Both Pro-Argin and Calcium Fluorophosphosilicate (CFPS)-based dentifrices demonstrated clinical efficacy in reducing dentinal hypersensitivity (DH) following non-surgical periodontal therapy. However, the CFPS dentifrice exhibited comparatively greater and more sustained reduction in DH, particularly evident at the 4- and 8-week follow-ups. These findings support the clinical utility of CFPS as a more effective post-NSPT desensitizing agent, likely owing to its bioactive, remineralizing properties and durable tubule occlusion. Within the limitations of this study, CFPS may be considered a preferred option for long-term management of DH in periodontally treated patients.

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