COMPARING THE EFFECT OF STANNOUS FLUORIDE TOOTHPASTE WITH PLACEBO IN TREATING DENTINAL HYPERSENSITIVITY

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ABSTRACT

OBJECTIVES

This study aimed to compare the efficacy of stannous fluoride toothpaste versus placebo in treating dentinal hypersensitivity.

METHODOLOGY

This quasi-experimental study was conducted at the Department of Periodontology, Rehman Medical Institute (RMI), Peshawar from July 25, 2023, to January 25, 2024. The study included 176 patients aged 18-70 years with at least two hypersensitive teeth. Participants were randomly divided into two groups: the test group (stannous fluoride toothpaste) and the control group (placebo). Sensitivity was measured at baseline, 3 minutes after application, and 15 days post-application using the Schiff Cold Air Sensitivity Scale (SCASS). Oral hygiene measures, clinical attachment loss, and gingival recession were also recorded. Data were analyzed using independent t-tests and Chi-square tests.

RESULTS

The test group showed significant improvement in SCASS scores compared to the control group (93.2% vs. 12.5%, p<0.001). Participants who used toothbrushes had significantly better outcomes than those using miswak or never engaging in oral hygiene. Participants who brushed more frequently experienced improved sensitivity relief, as effective brushing helps distribute the active fluorides uniformly across the teeth.

CONCLUSION

Stannous fluoride toothpaste significantly reduces dentinal hypersensitivity compared to placebo, supporting its use as an effective treatment for DH.

KEYWORDS: *Toothpaste, Hypersensitivity, Placebo, Fluoride*

INTRODUCTION

Dentin hypersensitivity (DH), an oral health condition that is not considered life-threatening but has a notable impact, has been found to have a significant effect on the quality of life experienced by numerous individuals. It manifests as a sudden, fleeting pain resulting from the exposure of dentin to different stimuli. This condition can significantly hinder individuals from fully savoring a diverse array of culinary experiences, thereby causing discomfort and emotional distress.[1] The prevalence of DH has been reported to range from 10% to 30% in the general population, with peak incidence observed in individuals aged 20–50 years.[2] It is most associated with gingival recession, enamel erosion, and aggressive toothbrushing practices.[3] The management of DH poses significant challenges due to its multifactorial etiology and individual variability in pain perception.[4] Broadly, treatment strategies can be categorized into two mechanisms: occlusion of dentinal tubules to prevent fluid flow or desensitization of interdental nerves to block pain transmission.[5] Considering the significant influence of dentin hypersensitivity (DH), there has been a growing emphasis within the dental field on the advancement of toothpaste compositions that incorporate diverse bioactive components, aiming to effectively tackle this condition.[6] Over-the-counter desensitizing toothpaste represents first-line intervention due to their ease of use, affordability, and accessibility. Active ingredients such as potassium nitrate, stannous fluoride, and arginine-calcium carbonate have been extensively studied for their efficacy in managing DH.[7] One notable development in the field of oral hygiene is the emergence of toothpaste infused with stannous fluoride. The ascent of DH treatments in the field of therapeutic breakthroughs has garnered significant interest, positioning them as a prominent solution in the pursuit of effective treatments. Stannous fluoride is widely recognized for its notable dual-action effectiveness, encompassing the ability to facilitate the remineralization process of tooth structures and safeguard the vulnerable dentinal tubules against various external stimuli.[8] Stannous fluoride (SnF2) forms an insoluble layer over exposed dentinal tubules, effectively reducing their permeability and subsequent fluid movement.[9] Additionally, SnF2 exhibits antimicrobial properties that may contribute to improved oral health by reducing plaque and

gingivitis.[10] This characteristic renders it a compelling choice in the realm of DH management, as it provides both prompt alleviation of symptoms and enduring advantages for dental well-being. Management strategies for DH are classified into two categories: occluding dentinal tubules to reduce fluid movement or desensitizing nerve endings to mitigate pain perception. Among the commonly used agents, stannous fluoride (SnF2) is particularly effective because it can occlude tubules by forming stannous oxides and hydroxides. These compounds precipitate on the dentinal surface, sealing exposed tubules and reducing fluid flow.[11] Studies using scanning electron microscopy (SEM) have demonstrated that SnF2 forms a durable barrier over dentin, suggesting long-lasting effects compared to alternatives like potassium nitrate or sodium fluoride.[12] Recent clinical investigations emphasize the dual action of SnF2: occlusion of dentinal tubules and antimicrobial activity, which contributes to its anti-inflammatory properties. Stannous fluoride has also been shown to significantly outperform other desensitizing agents, including arginine-based compounds and potassium nitrate, regarding onset and duration of relief.[13] Furthermore, formulations combining SnF2 with other active agents, such as sodium fluoride or calcium phosphates, have synergistic effects in promoting dentin remineralization and tubule occlusion.[14] Despite its efficacy, the widespread adoption of stannous fluoride has been limited by potential side effects, such as surface staining, and a lack of long-term comparative studies. Placebo-controlled trials are essential to isolate the specific impact of SnF2 from the placebo effect, as psychological factors often influence self-reported pain relief in DH studies. This research aims to evaluate the efficacy of SnF2 toothpaste compared to placebo in reducing DH, employing rigorous clinical methodologies to address these challenges.

METHODOLOGY

This quasi-experimental study evaluated the efficacy of stannous fluoride toothpaste in treating dentinal hypersensitivity compared to a placebo. Conducted in the Department of Periodontology at Rehman College of Dentistry between July 25, 2023, and January 25, 2024, the study targeted patients reporting dentinal hypersensitivity. Using the World Health Organization's sample size calculator, 176 participants were determined as the required sample size, ensuring 80% power and a 5% significance level. This calculation was based on a 27.8% hypersensitivity relief rate in stannous fluoride users and 42% in placebo users, drawn from prior research. Participants were selected through non-probability consecutive sampling. Eligibility criteria included adults aged 18-70 with at least two hypersensitive teeth anterior to molars, whose hypersensitivity arose from attrition, abrasion, erosion, or gingival recession, provided they were otherwise healthy and had no known allergies to the test products. Exclusion criteria eliminated individuals with advanced periodontal disease, carious lesions, or mobility greater than 1, as well as those who had used desensitizing toothpaste in the last three months or were on certain medications such as anticonvulsants, sedatives, or anti-inflammatory drugs. Ethical approval was obtained from the Institutional Ethics Review Committee, and all participants provided written informed consent. Patients were divided into two groups: one received stannous fluoride toothpaste (test group), while the other received a placebo without active ingredients (control group). Dentinal sensitivity was assessed using the Schiff Cold Air Sensitivity Scale, with readings taken at baseline, three minutes after application, and fifteen days later to evaluate sustained relief. Participants were given detailed usage instructions for their assigned toothpaste and were monitored during follow-ups. Data were analyzed using SPSS Version 26, where continuous variables like age and clinical attachment loss were expressed as means and standard deviations, while categorical variables such as gender and brushing frequency were summarized as percentages. Relationships between categorical variables were evaluated using the chi-square test, and stratification accounted for modifiers like age and brushing habits. A p-value ≤ 0.05 was considered statistically significant for all analyses.

RESULTS

Table 1: Descriptive Statistics of Study (n=176)

Variable	Group	Mean	Std. Deviation	P-Value
Age (Years)	Test Group	43.88	15.925	0.949
	Control Group	44.02	14.702	
SCASS Score	Test Group	0.13	0.543	0.000
	Control Group	1.68	0.989	
Clinical Attachment Loss (mm)	Test Group	2.734	1.2506	0.806
	Control Group	2.781	1.2865	

Table 2: Frequencies and Percentages for Recession, Oral Hygiene and Tooth Brushing in Test and Control Group

Variable		Test Group (n=88)	Control Group (n=88)	P-Value
Recession	Yes	49 (55.7%)	47 (53.4%)	0.762
	No	39 (44.3%)	41 (46.6%)	
Oral Hygiene Measures	Miswak	16 (18.2%)	20 (22.7%)	0.037
	Toothbrush	16 (18.2%)	23 (26.1%)	
	Others	28 (31.8%)	12 (13.6%)	
	Never	28 (31.8%)	33 (37.5%)	
Tooth Brushing Frequency	Twice Daily	12 (13.6%)	10 (11.4%)	0.815
	Once Daily	15 (17.0%)	12 (13.6%)	
	Occasionally	19 (21.6%)	18 (20.5%)	
	Never	42 (47.7%)	48 (54.5%)	

Table 3: Comparison of Efficacy in both Groups

		Efficacy of		P-Value
		Yes n (%)	No n (%)	
Group	Test Group	82 (93.2)	06 (6.8)	< 0.001
	Control Group	11 (12.5)	77 (87.5)	

Table 4: Stratification of Efficacy of stannous fluoride with Oral Hygiene Measures and Tooth Brushing Frequency.

Variable		Group	Efficacy		P-Value
			Yes n (%)	No n (%)	
Oral Hygiene Measures	Miswak	Test Group	15 (93.8)	01 (6.3)	< 0.001
		Control Group	01 (5.0)	19 (95.0)	
	Toothbrush	Test Group	16 (100.0)	0 (0.0)	< 0.001
		Control Group	06 (26.1)	17 (73.9)	
	Others	Test Group	27 (96.4)	01 (3.6)	< 0.001
		Control Group	02 (16.7)	10 (83.3)	
	Never	Test Group	24 (85.7)	04 (14.3)	< 0.001
		Control Group	02 (6.1)	31 (93.9)	
Tooth Brushing Frequency	Twice Daily	Test Group	12 (100.0)	0 (0.0)	< 0.001
		Control Group	01 (10.0)	09 (90.0)	
	Once Daily	Test Group	15 (100.0)	0 (0.0)	< 0.001
		Control Group	0 (0.0)	12 (100.0)	
	Occasionally	Test Group	19 (100.0)	0 (0.0)	< 0.001
		Control Group	01 (5.6)	17 (94.4)	
	Never	Test Group	36 (85.7)	06 (14.3)	< 0.001
		Control Group	09 (18.8)	39 (81.3)	

DISCUSSION

The results of this study provide compelling evidence for the efficacy of stannous fluoride (SnF2) toothpaste in treating dentinal hypersensitivity (DH) compared to a placebo. The demographic data reveal no significant differences in age between the test (43.88 ± 15.93) and control (44.02 ± 14.70) groups (p = 0.949). This homogeneity indicates that age-related differences did not influence treatment outcomes. Similarly, clinical attachment loss (CAL) was comparable in the test (2.73 ± 1.25 mm) and control (2.78 ± 1.29 mm) groups (p = 0.806), indicating that periodontal health was consistent across groups. This alignment with baseline characteristics is crucial for minimizing confounding variables, as a study noted that periodontal health can influence pain perception in DH studies.[15] However, the Schiff Cold Air Sensitivity Scale (SCASS) scores differed significantly (p < 0.001) between groups. The test group (mean SCASS = 0.13 ± 0.54) showed a substantial reduction compared to the control group (mean SCASS = 1.68 ± 0.98), indicating the ability of SnF2 to reduce dentinal hypersensitivity. Similar decreases in SCASS scores have been reported in other studies evaluating SnF2, noting that stannous fluoride offers rapid occlusion of dentinal tubules and is more effective than placebo-based interventions.[8] The efficacy of stannous fluoride toothpaste was significantly higher than that of placebo. In the test group, 82 participants (93.2%) reported relief from DH, while only 11 participants (12.5%) in the control group reported relief (p < 0.001). This result is consistent with previous researchers who found that SnF2 significantly reduces hypersensitivity within a short period, owing to its rapid occlusion of exposed dentinal tubules.[16] The dual action of SnF2, occlusion of tubules, and antibacterial properties provide a strong basis for its superiority over placebo-based treatments. These findings also mirror those reported similar levels of efficacy in a clinical trial of SnF2 for DH.[13] The stratification of efficacy by oral hygiene measures revealed that participants who used toothbrushes (100% efficacy) and "others" (96.4%) had significantly better outcomes compared to those using miswak (93.8%) or never engaging in oral hygiene (85.7%). This is a critical finding, as it suggests that proper oral hygiene practices enhance the effectiveness of stannous fluoride. Previous research highlighted that [12,17] The control group had notably lower efficacy across all oral hygiene measures, with miswak users showing only 5% efficacy and toothbrush users achieving 26.1%. The discrepancy is likely due to the absence of the active agent (SnF2) in the placebo toothpaste. Tooth brushing frequency was another variable that significantly influenced treatment efficacy. This observation underscores the role of regular brushing in enhancing the effect of stannous fluoride. Regular brushing may facilitate more effective and even distribution of SnF2 across dentin surfaces, thereby increasing tubule occlusion. The frequency of oral hygiene practices could influence the efficacy of desensitizing toothpaste.[18] Participants who brushed more frequently experienced improved sensitivity relief compared to irregular brushers, as effective brushing helps distribute the active fluoride ions uniformly across the teeth.[19] The enhanced action of SnF2 can be attributed to its unique ability to form a consistent protective layer of stannous complexes over dentinal tubules.[20] The results of this study align with previous findings in the literature regarding the efficacy of SnF2 in treating dentinal hypersensitivity. The findings provide a more comprehensive understanding of how oral hygiene

measures and tooth brushing frequency influence the effectiveness of SnF2. Additionally, the finding that oral hygiene methods like brushing with a toothbrush result in greater efficacy compared to using miswak or no hygiene practices has practical significance. Although miswak is a traditional and culturally significant oral hygiene tool in many regions, its use may not be as effective as stannous fluoride toothpaste. This finding calls for increased awareness regarding the role of modern oral hygiene methods in enhancing the action of advanced dentifrice formulations like SnF2 toothpaste.

LIMITATIONS

The limitations of the study are the subjectivity of self reported outcomes and the relatively short follow-up period. The findings strongly support the use of stannous fluoride as an effective treatment option. Future research should explore long-term efficacy and investigate the role of dietary factors and emerging treatments, such as bioactive materials, to enhance DH management and improve patient outcomes.

CONCLUSIONS

Stannous fluoride toothpaste is significantly more effective than placebo in reducing dentinal hypersensitivity influenced by oral hygiene measures and brushing frequency. The ability of stannous fluoride to occlude dentinal tubules and prevent fluid movement, which is responsible for the pain in DH, was evident in the marked reduction in SCASS scores among the test group.

CONFLICT OF INTEREST: None

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