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Short Report

Stannous Fluoride Toothpaste: Improving gingival health without a new habit adoption

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ABSTRACT

Purpose Dental hygienists are uniquely positioned to improve oral and overall health outcomes with evidence-based treatment plans. One recommendation that has yet to see its full potential is the use of stannous fluoride (SnF_2) toothpaste. Stannous fluoride is more than just an anticaries agent. Its formulation within a toothpaste offers superior performance in reducing plaque, gingivitis, sensitivity, halitosis, and tooth erosion, while maintaining the sulcular barrier integrity. However, most patients are unaware of these easily available benefits for oral health. This short report highlights the universal efficacy of SnF_2 toothpaste, including significant reductions in gingival bleeding as compared with regular fluoride; reviews its proposed mechanisms, including antibacterial and antivirulence activity around teeth and implants as well as substructure remineralization; and explores its potential systemic health impact. The specific formulation of the toothpaste product also affects these factors, emphasizing the value of formulation-specific evidence to inform chairside recommendations. Including a well-formulated SnF_2 toothpaste as part of daily oral hygiene leverages an existing behavior and reinforces proper habits for better oral health outcomes.

Keywords stannous fluoride, oral hygiene, toothpaste, anti-gingivitis, periodontal disease, dental implants, prevention, dentinal hypersensitivity

NDHRA priority area, **Client level; Oral health care** (health promotion; treatments, behaviors, products).

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INTRODUCTION

Gingivitis, inflammation of the gingiva due to an undisturbed accumulation of dental biofilm,[1,2] is widespread globally among adults and can advance to periodontitis based on various local, patient, and environmental risk factors.[2-5] The rate of severe periodontitis has increased globally and has been associated with increases in the aging population.[6] When gingival inflammation is addressed early, through effective biofilm disruption, it not only improves oral health outcomes but may also reduce the potential for systemic complications.[7] Therefore, preventing, diagnosing, and treating gingivitis through effective tools and patient education is foundational to long-term success for positive oral health outcomes.

According to the 2025 Standards for Clinical Dental Hygiene Practice,[8] the dental hygienist utilizes evidence-based research and guidelines to provide safe and effective care that involves the patient as a co-therapist. Dental hygiene interventions are preventive, educational, and therapeutic with a focus on reducing, eliminating or preventing oral disease, underscoring the importance of early

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diagnosis and treatment of gingivitis. Within this preventive and therapeutic framework, effective biofilm control remains the first line of defense. Twice-daily mechanical plaque control through toothbrushing and interdental cleaning along with professional prophylaxis is foundational and can reverse and prevent early stages of periodontal disease. The success of these approaches relies heavily on patient knowledge, adherence, and dexterity;[9,10] and consequently high disease prevalence persists. This challenge has prompted researchers and manufacturers to develop supplemental technologies to assist patients with plaque control, including home care products with chemotherapeutics to extend the benefits of mechanical oral hygiene.[11] Among these products, stannous fluoride (SnF_2) toothpaste has been evaluated extensively for its ability to provide both anticaries and antimicrobial benefits, supporting its role as a chemotherapeutic adjunct in oral health promotion and gingivitis management.[12,13]

In spite of what is known in the literature about the chemotherapeutic benefits of toothpaste products, in an international study of dental hygienists, 40% of the participants reported that they do not make specific toothpaste recommendations to their patients.[14] This lack of recommendation may be due to the finding that over half (58%) of the participants believed that all fluoride toothpastes were essentially the same and equally effective.[14] However, a large body of evidence demonstrates that toothpaste selection can meaningfully support significant reductions in gingival inflammation and bleeding sites,[12,15-17] and although over-the-counter toothpastes are readily available, product recommendations should be considered as therapeutic measures and included in the dental hygiene care plan.

Among the available self-care therapies, SnF_2-containing toothpastes stand out as a leading evidence-based option.[12,15-21] Although sodium fluoride and sodium monofluorophosphate are established anticaries agents,[13] SnF_2 has been shown to not only deliver an anticaries benefit[13] but also a variety of other health benefits, including control of plaque, gingivitis, halitosis, hypersensitivity, and dental erosion[12,15-21] (Figure 1). Stannous fluoride's main mechanism is that it exerts a bacteriostatic effect, inhibiting plaque growth,[17,21] and the metabolic production of acids[22] and toxic byproducts.[23] In addition, SnF_2 binds to bacterial toxins including lipopolysaccharides (LPS), thus preventing inflammatory signaling, while maintaining sulcular barrier integrity.[24,25]

Figure 1. Oral health benefits of toothpastes containing fluoride formulations

		Regular Fluoride*	Stannous Fluoride
Remineralization	Anti-caries	✓	✓
Anti-microbial	Bacterial plaque		✓
	Gingival health		✓
	Malodorous bacteria		✓
Barrier against acid	Erosion protection		✓
Occludes dentinal tubules	Sensitivity		✓

*Sodium fluoride, sodium monofluorophosphate

Use of a well-formulated SnF_2 toothpaste is not only backed by decades of clinical research evidence,[12,17-21] but it is easy for patients to implement, as switching to a SnF_2 toothpaste reinforces an existing habit. In addition, contemporary formulated SnF_2 toothpastes are widely available. Collectively, these findings support the concerted effort to incorporate SnF_2 into evidence-based self-care recommendations and patient education. The purpose of this short report is to summarize the benefits of SnF_2 for oral and systemic health.

Gingival Bleeding Benefits

The absence of gingival bleeding is a clinically relevant endpoint since persistent bleeding sites are associated with a higher risk of periodontal and peri-implant disease progression that can lead to tooth or implant loss.[26,27] Extensive evidence shows that SnF_2 reduces gingival bleeding, with greater effects relative to dentifrice control groups as reported in multiple systematic reviews and meta-analyses.[12,17,18,28-30] One example is a meta-analysis which synthesized data

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from 18 randomized controlled trials representing nearly 3000 participants.[12] Findings showed that among participants with baseline gingivitis, 68% of those who used gluconate-chelated SnF_2 (e.g., gluconate was used to stabilize the SnF_2 in those formulations) achieved healthy gingival status after less than three months of use; an outcome representing 3.7 times better odds of transitioning from a state of gingivitis to a state of gingival health compared to sodium fluoride or sodium monofluorophosphate toothpaste.[12] Notably, bleeding sites were reduced by 51% among SnF_2 users compared to participants using the negative control.[12] This was further demonstrated in a separate pooled analysis of randomized, controlled clinical trials with up to six months of SnF_2 use, which showed bleeding reduction as early as one month, increased by three months, and was maintained for six months.[31] The consistent and sustained reduction in gingival bleeding observed with SnF_2 use underscores its role as a practical, evidence-based intervention to improve gingival health and reduce periodontal and peri-implant diseases over time.

Plaque Coverage and Virulence

Stannous fluoride supports gingival health through two complementary plaque-related mechanisms, reinforcing the importance of effective daily plaque control. As part of a twice-daily toothbrushing routine, SnF_2 dentifrice has been shown to significantly reduce plaque coverage.[17,18] This benefit has been demonstrated in a pooled analysis of 44 long-term and short-term studies with over 3300 participants.[21] Participants using SnF_2 had significantly lower plaque coverage than positive and negative controls, even on unbrushed surfaces.[21]

Mechanistically, SnF_2 acts on the plaque biofilm itself where it modifies microbial metabolism and reduces the abundance of inflammation-promoting bacteria.[32-34]

A 2024 investigation showed that SnF_2 penetrates the outer membranes of *Prevotella pallens* and *Porphyromonas gingivalis*, two species known to be associated with gingivitis.[33] In a dose-dependent manner, SnF_2 precipitates were associated with membrane disintegration and reduced bacterial growth. A separate study similarly reported that biofilms treated in situ with a SnF_2-based toothpaste had smaller counts of periopathogenic species, such as *P. gingivalis,* and increased counts of commensal species, like *Streptococcus gordonii.*[34] Together these findings indicate a shift in the oral microbiome toward a composition consistent with gingival health. Importantly, separate research shows that this oral microbiome shift was still observed after three years of use, demonstrating its long-term positive effects.[35]

Stannous fluoride also modulates bacterial virulence and host inflammatory signaling, combining plaque control with virulence suppression. During acute gingival inflammation, host cells respond to bacterial challenge through specialized pattern-recognition receptors (PRRs), called toll-like receptors (TLRs), which recognize pathogen-associated molecular patterns (PAMPs) expressed by pro-inflammatory bacteria. Activation of TLR signaling on epithelial and immune cells, including neutrophils and macrophages,[4,36] initiates the recruitment of immune cells[4,34] and the production of proinflammatory cytokines and chemokines such as tumor necrosis factor-α (TNF-α), interleukin-1β (IL-1β), and interleukin-8 (IL-8).[4,38,39] While these responses are critical for host defense, the effective and timely resolution of these inflammatory challenges prevents permanent damage to the periodontal and/or peri-implant apparatus. [4,40]

The reduction of the aforementioned virulence factors can protect the hard and soft tissues around teeth and dental implants. Plaque samples collected from participants who used a SnF_2 toothpaste for four weeks showed significant reduction in TLR activation along with reductions in gram-negative, anaerobic bacteria.[41] Furthermore, SnF_2 targets outer membrane vesicles (OMVs), which are produced by gram-negative bacteria such as *P. gingivalis.* Outer membrane vesicles contain a variety of components responsible for modulating the host immune response, including gingipains, *P. gingivalis* peptidylarginine deiminases (PPADs), and LPS, thereby potentiating inflammation, oxidative stress, and epithelial tissue damage.[42-44] Stannous fluoride can however bind

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to OMVs and reduce their infectivity and associated oxidative stress.[44]

Together, these mechanisms help maintain the sulcular epithelial barrier.[24,25,44] In participants with gingivitis, twice-daily, two-month use of SnF_2 toothpaste produced reductions in gingivitis and bleeding but also significantly increased salivary antioxidant capacity and decreased salivary markers of oxidative stress.[23] Furthermore, among individuals with elevated cardiovascular disease (CVD) risk, as determined by C-reactive protein (CRP) and oxidized low-density lipoprotein (LDL) markers, both CRP and LDL were significantly reduced in saliva after treatment, highlighting the potential relevance of SnF_2 for patients with these comorbidities.[23] Controlling the overall bacterial load with the proper self-care system may lessen the inflammatory burden for different cardiac and metabolic conditions.

These findings highlight that SnF_2 not only improves plaque control but favorably alters the biofilm and host response, resulting in clinically meaningful reductions in plaque, gingival inflammation, and bleeding. For the dental professional, this reinforces the value of introducing a twice-daily, well-formulated SnF_2 dentifrice to enhance daily self-care, support long-term periodontal stability, and help in the management of patients at higher risk for systemic diseases.

Peri-Implant Mucositis

A SnF_2 dentifrice also supports daily oral hygiene for dental implants. This is a critical need as more patients receive implant therapy for single tooth replacement and full-arch reconstruction,[45] in addition to the peri-implant soft tissue complex, where parallel-oriented connective tissue fibers create a structurally vulnerable interface for biofilm infiltration. Disease at this interface can progress much faster, often exponentially, than around natural teeth.[46] The incidence rate for peri-implant mucositis has been shown to be 53% within 20 years of function.[47]

A pilot study evaluated the effects of a SnF_2 dentifrice among participants with osseointegrated dental implants presenting with peri-implant mucositis. After using SnF_2 toothpaste twice-daily for four weeks, gingival inflammation and bleeding were significantly reduced. In addition, due to the previously described mechanisms, the oral microbiome shifted from one characteristic of disease toward that of no mucositis.[48] Importantly, at a near-neutral pH, toothpastes with SnF_2 are safe and recommended for use with titanium implants.[49] Clinically, these findings reinforce the role of a SnF_2-containing dentifrice as a practical adjunct in implant maintenance and primary prevention, offering dental hygienists an evidence-based tool to help control inflammation, stabilize the peri-implant microbiome, and reduce the risk of peri-implant disease progression.

Stannous Fluoride Formulation

The formulation of a SnF_2 toothpaste is critical to its efficacy[15,16] as well as controlling extrinsic staining.[50-52] Divalent stannous ions are highly reactive, and it is challenging to formulate a toothpaste that retains antibacterial efficacy.[15,16] Therefore, production to maximize the clinical benefits of SnF_2 toothpaste requires careful optimization, and not all marketed SnF_2 toothpastes should be considered equal. In a three-month comparison of toothpastes containing identical concentrations of SnF_2, but formulated with different excipients, significant differences were seen in the number of bleeding sites reduced and in the gingivitis index score at 2, 4, and 12 weeks of use.[15] Similarly, in a three-month comparison of three formulations with identical SnF_2 concentration but different levels of SnF_2 bioavailability, the high bioavailable SnF_2 formulation showed the greatest significant bleeding site benefit over a negative control.[16] Such differences are attributable to differences in inactive ingredients and formulation chemistry, which in turn impacts the stability and bioavailability of SnF_2.

Hard Tissue Benefits

Stannous fluoride has also shifted the conversation on sensitivity relief. Systematic reviews and meta-analyses have revealed the efficacy of SnF_2 with respect to reducing dental hypersensitivity via durable, acid resistant, tubule occlusion, with statistically significant benefits observed relative to both positive

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and negative controls.[19,20] In a recent publication of a randomized clinical trial, SnF_2 toothpaste provided faster, more effective sensitivity relief compared to a potassium nitrate toothpaste.[53] Significant benefits have also been observed for reduction of dental erosion, attributable to the formation of an acid-resistant layer that protects the enamel and exposed dentin from pH challenge.[19,20]

CONCLUSION

Stannous fluoride provides a range of soft and hard tissue benefits that improve oral health and have positive implications on systemic health. A simple switch to a modern SnF_2 formulation, supported by decades of clinical research, falls within a daily oral hygiene habit already established by patients. For individuals who do not brush consistently, this remains one of the easiest and most accessible first steps toward improving their oral and overall health.

IMPLICATIONS FOR DENTAL HYGIENE PRACTICE

- Oral diseases, particularly periodontal disease, are prevalent globally and have a negative impact on patients' oral health, with potential systemic consequences.
- As part of a person-centered approach to oral care, recommendations for over-the-counter products with therapeutic benefits can play a critical role in extending the benefits of mechanical oral hygiene habits.
- Dental hygienists should consider recommending a well-formulated SnF_2 toothpaste, when clinically indicated, as part of an easy-to-implement, evidence-based therapeutic product to improve and maintain periodontal and peri-implant health, protect hard tissues, and reduce the burden of oral and systemic inflammation.

DISCLOSURES

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