

STANNOUS FLUORIDE

INHIBITS PLAQUE GROWTH

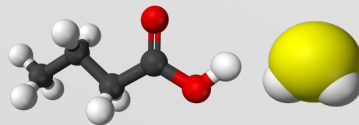
DUAL ACTION

1 Bactericidal

- Disruption of bacterial cell membrane leading to cell death
 - Mode of action most commonly found in antibacterial toothpaste and rinses

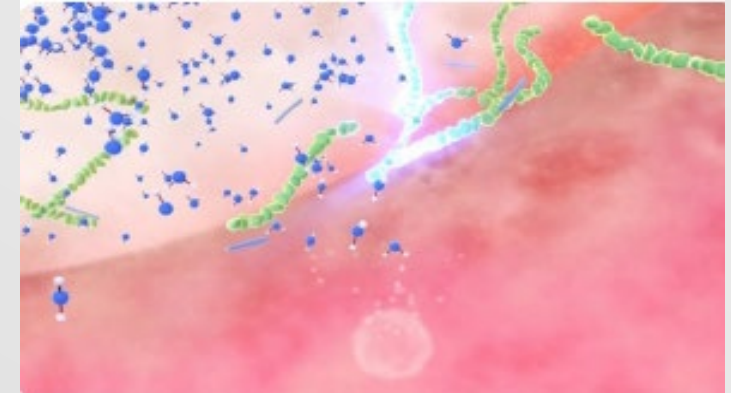
2 Bacteriostatic

- Inhibition of metabolic activity leading to:
 - Inhibition of bacterial growth
 - Reducing extracellular polysaccharides (EPS) so biofilm is thin and less sticky, limiting ability to adhere to oral surfaces
 - Limits sugar metabolism and the production of VSCs and Short Chain Fatty Acids which boost inflammation leading to gingivitis
 - Binds to LPS reducing toxicity of Biofilm
 - Targets Red Complex Bacteria (GNA's); shifts the microbiome toward healthy, non-inflammatory state.
 - Reduces Markers of Oxidative Stress



SCFA & VSCs

Disruption of bacterial cell membrane leading to cell death.

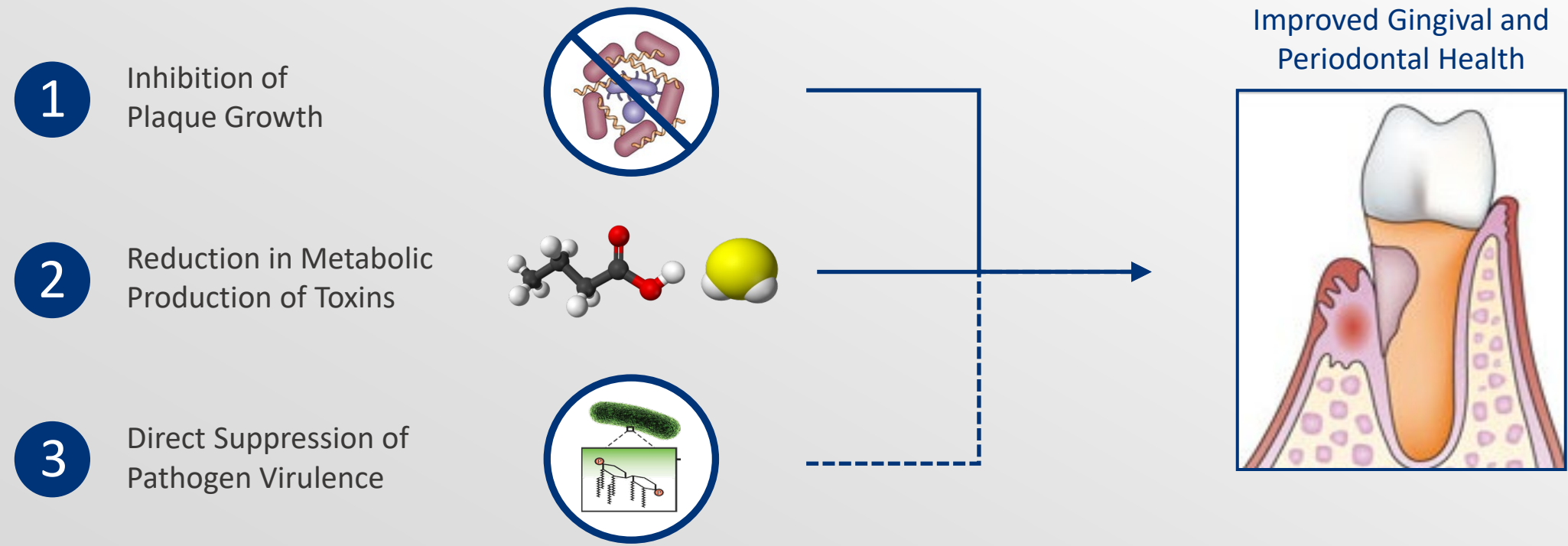


Remaining bacteria have significantly reduced metabolic activity and are less thick and sticky.



Stannous interferes with bacteria carbohydrate metabolism by blocking enzymes converting sugars to short chain fatty acids.

THE THERAPEUTIC PROPERTIES OF STANNOUS FLUORIDE FOR GINGIVAL HEALTH MECHANISMS OF ACTION





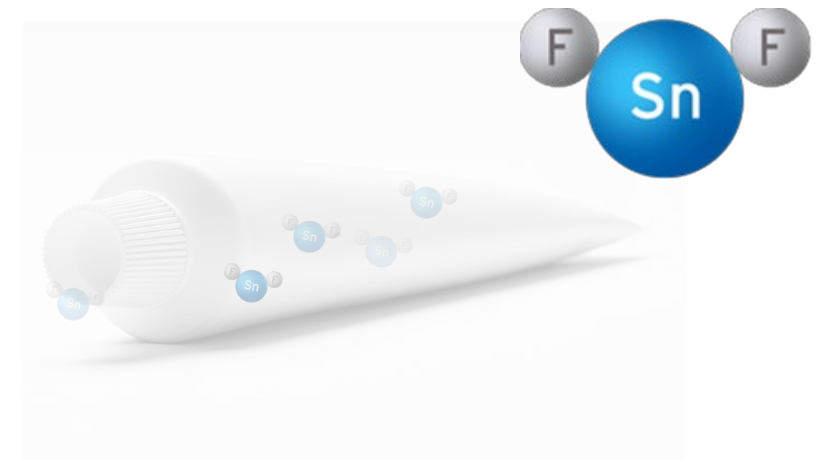
Comparison of Magnitude of Benefit

Bleeding Reduction

Flossing at 2 weeks = 40%¹

Prophy Benefit 1 week post visit = 40 – 66%²

SnF2 at 3 months versus NaF = 51%³



This Meta-Analysis shows brushing with P&G Stannous provides a **51% reduction in bleeding sites in up to 3 months vs Negative Control.**

1. Biesbrock, A., et al. *Journal of Periodontology* 2006; 77: 1386-1391.

2. McClanahan, et al.. *Journal of Periodontology* 2001; 72: 383-392.

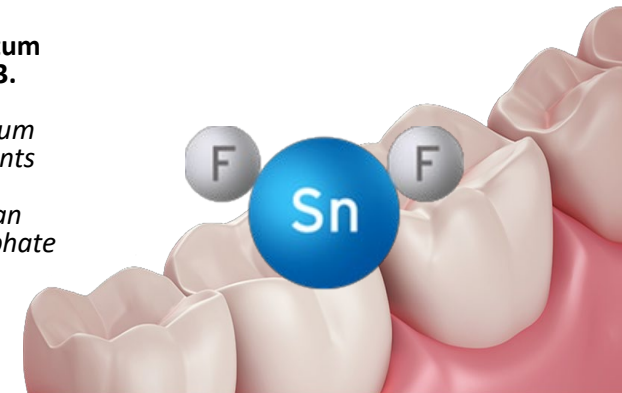
3. Biesbrock, A et al. The Effects of Bioavailable Gluconate Chelated Stannous. Fluoride Dentifrice on Gingival Bleeding: Meta-Analysis of Eighteen Randomized Controlled Trials. *J Clin Periodontal*, 2019.

External Sources

2020 – Sanz M, Herrera D, Kebschull M, Chapple I, Jepsen S, Beglundh T, Sculean A, Tonetti MS; EFP Workshop Participants and Methodological Consultants. Treatment of stage I-III periodontitis-The EFP S3 level clinical practice guideline. J Clin Periodontol. 2020 Jul;47 Suppl 22(Suppl 22):4-60. doi: 10.1111/jcpe.13290. Erratum in: J Clin Periodontol. 2021 Jan;48(1):163. PMID: 32383274; PMCID: PMC7891343.

“If an antiseptic dentifrice formulation is going to be adjunctively used, we suggest products containing chlorhexidine, triclosan copolymer and stannous fluoride-sodium hexametaphosphate for the control of gingival inflammation, in periodontitis patients in supportive periodontal care.”

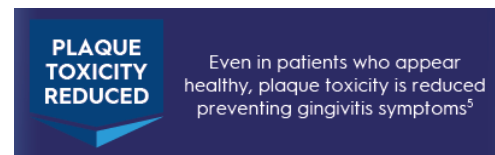
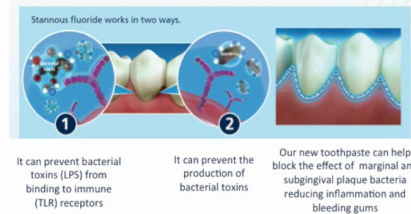
“The magnitude of effect in gingival indices changes, in formulations with more than one study available, was headed by stannous fluoride with sodium hexametaphosphate (n = 2, S-WMD = -1.503), followed by triclosan and copolymer (n = 18, S-WMD = -1.313), and chlorhexidine (n = 2, S-WMD = -1.278, not statistically significant)”



Key Outcome	<i>This meta-review appraised the current state of evidence and found that toothbrushing with a standard fluoride dentifrice does not provide an added effect for the mechanical removal of dental plaque</i>	<i>The present review found that stabilized SnF2 toothpaste had a positive effect on the reduction of dental calculus build-up, dental plaque, gingivitis, stain and halitosis. A tendency towards a more pronounced effect than using toothpastes not containing SnF2 was found.</i>	<i>The studies in this systematic review provide strong evidence of the antiplaque, antigingivitis effects of multiple agents. These results support the use of these agents as part of a typical oral hygiene regimen.</i>	<i>“The use of stabilized stannous fluoride dentifrices to relieve dentin hypersensitivity and to prevent the initiation of dental erosion speaks in favor of this treatment strategy”</i>	The use of SnF(2) dentifrices results in gingivitis and plaque reduction when compared with a conventional dentifrice. The precise magnitude of this effect was difficult to assess because of a high level of heterogeneity in study outcomes.	<i>“The antibacterial properties of stannous seem to provide favourable results when formulated with a fluoridated toothpaste.”</i>	The studies in this systematic review provide strong evidence of the antiplaque, antigingivitis effects of multiple agents. These results support the use of these agents as part of a typical oral hygiene regimen.	Conclusions: A new dentifrice with 0.454% stannous fluoride and 2.6% EDTA demonstrated significant improvements in clinical parameters associated with gingivitis compared to other sodium and stannous fluoride containing dentifrices.
Citation	Valkenburg C, Van der Weijden FA, Slot DE. Plaque control and reduction of gingivitis: The evidence for dentifrices. Periodontol 2000. 2019 Feb;79(1):221-232. doi: 10.1111/prd.12257. PMID: 30892760; PMCID: PMC7328759.	Johannsen A, Emilson CG, Johannsen G, Konradsson K, Lingström P, Ramberg P. Effects of stabilized stannous fluoride dentifrice on dental calculus, dental plaque, gingivitis, halitosis and stain: A systematic review. Heliyon. 2019 Dec 9;5(12):e02850. doi: 10.1016/j.heliyon.2019.e02850. PMID: 31872105; PMCID: PMC6909063	Gunsolley, J. C. (2006). A meta-analysis of six-month studies of antiplaque and antigingivitis agents. Journal of the American Dental Association, 137, 1649-1657.	Konradsson K, Lingström P, Emilson CG, Johannsen G, Ramberg P, Johannsen A. Stabilized stannous fluoride dentifrice in relation to dental caries, dental erosion and dentin hypersensitivity: A systematic review. Am J Dent. 2020 Apr;33(2):95-105.	Paraskevas, S., & Van der Weijden, G. A. (2006). A review of the effects of stannous fluoride on gingivitis. Journal of Clinical Periodontology, 33, 1-13	Clark-Perry D, Levin L. Comparison of new formulas of stannous fluoride toothpastes with other commercially available fluoridated toothpastes: A systematic review and meta-analysis of randomised controlled trials. Int Dent J. 2020 Dec;70(6):418-426. doi: 10.1111/idj.12588. Epub 2020 Jul 4.	Sälzer, S., Slot, D. E., Dörfer, C. E., & Van der Weijden, G. A. (2015). Comparison of triclosan and stannous fluoride dentifrices on parameters of gingival inflammation and plaque scores: A systemic review and meta-analyses. International Journal of Dental Hygiene, 13, 1-17.	Geisinger ML, Geurs NC, Novy B, Otomo-Corgel J, Cobb CM, Jacobsen PL, Takesh T, Wilder-Smith P. A randomized double-blind clinical trial evaluating comparative plaque and gingival health associated with commercially available stannous fluoride-containing dentifrices as compared to a sodium fluoride control dentifrice. J Periodontol. 2023 Sep;94(9):1112-1121. doi: 10.1002/JPER.22-0675. Epub 2023 Apr 26. PMID: 37016272; PMCID: PMC10524004.

Stannous Fluoride Can Help In Two Ways

MoA Plaque Toxicity



KEY QUESTION:	To identify technology that binds to LPS	Does Stannous interfere with LPS and LTA Activation	Understand if blocking LPS inhibits endotoxin activation of TLR inflammatory cascade	Does Stannous inhibit cytokine production per various monocytes	Subgingival uptake and retention of stannous fluoride from dentifrice: Gingival crevicular fluid concentrations in sulci post-brushing	Clinical effects of Sn fluoride dentifrice in reducing Plaque microbial Virulence in various level of disease	Clinical effects of stannous fluoride dentifrice in reducing plaque microbial virulence III: Lipopolysaccharide and TLR2 reporter cell gene Activation
Citation	Haught JC, Xie S, Circello B, Tansky CS, Khambe D, Sun Y, Lin Y, Sreekrishna K, Klukowska M, Huggins T, White DJ. Lipopolysaccharide and lipoteichoic acid binding by antimicrobials used in oral care formulations. Am J Dent. 2016 Dec;29(6):328-332. PMID: 29178720.	Haught JC, Xie S, Circello B, Tansky CS, Khambe D, Sun Y, Lin Y, Sreekrishna K, Klukowska M, Huggins T, White DJ. Lipopolysaccharide and lipoteichoic acid binding by antimicrobials used in oral care formulations. Am J Dent. 2016 Dec;29(6):328-332. PMID: 29178720.	Lipopolysaccharide and Lipoteichoic Acid Virulence Deactivation by Stannous Fluoride	Lipopolysaccharide and Lipoteichoic Acid Virulence Deactivation by Stannous Fluoride	Subgingival uptake and retention of stannous fluoride from dentifrice: Gingival crevicular fluid concentrations in sulci post-brushing	Klukowska M, Haught JC, Xie S, Circello B, Tansky CS, Khambe D, Huggins T, White DJ. Clinical Effects of Stabilized Stannous Fluoride Dentifrice in Reducing Plaque Microbial Virulence I: Microbiological and Receptor Cell Findings. J Clin Dent. 2017 Jun;28(2):16-26. PMID: 28657701.	Clinical effects of stannous fluoride dentifrice in reducing plaque microbial virulence III: Lipopolysaccharide and TLR2 reporter cell gene activation.
Result	Mass spectroscopy revealed direct binding of stannous fluoride LPS at 1:1 stoichiometric ratios. In the cellular assay, cetylpyridinium chloride and stannous fluoride, but not triclosan, inhibited LPS binding to TLR4.	Stannous salts including stannous fluoride interfered with LPS and LTA reactivity in both dye assays. Lipopolysaccharide and lipoteichoic acid binding by antimicrobials used in oral care formulations	Stannous fluoride inhibited gene expression response of TLR4 and TLR2.	The addition of stannous fluoride suppressed production of TNF-a, IFN-g, IL12p70, IL10, IL-1b, IL2, and IL-6, and increased secretion of IL-8 in dose response fashion. Lipopolysaccharide and Lipoteichoic Acid Virulence Deactivation by Stannous Fluoride.	Significant levels of tin, were detected 30 minutes after brushing at sampling sites up to 4 mm subgingivally and showed an increasing trend with continued use. Subgingival uptake and retention of stannous fluoride from dentifrice: Gingival crevicular fluid concentrations in sulci post-brushing	Clinical assessments showed statistically significant reductions in MGI (24–26%) and GBI (42–53%) gingivitis in both diseased and healthy cohorts following four weeks of dentifrice intervention. Benefits could be seen in both diseased sites, as well as sites not yet exhibiting symptoms of inflammation, supporting the activity of SnF2 not just in treating diseased sites, but also in preventing disease development.	Higher disease cohorts and sites with gingival inflammation generally showed more endotoxins and higher levels of plaque virulence as compared to low disease cohorts or plaque sampled from clinically healthy sites. SnF2 dentifrice treatment was associated with broad scale reductions in endotoxin content and virulence potentiation properties of dental plaque samples.
Link	https://pubmed.ncbi.nlm.nih.gov/29178720/	https://www.ncbi.nlm.nih.gov/pubmed/29178720	https://pubmed.ncbi.nlm.nih.gov/29178719/	https://www.ncbi.nlm.nih.gov/pubmed/28390203	https://www.ncbi.nlm.nih.gov/pubmed/30106533	https://www.ncbi.nlm.nih.gov/pubmed/28657701	https://www.ncbi.nlm.nih.gov/pubmed/30106539

Huggins T, Haught JC, Xie S, Tansky CS, Klukowska M, Miner MC, White DJ. Quantitation of endotoxin and

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Up to 4 mm below the Gum line Substantive for 12 hours

Neutralizes gingivitis causing toxins. Even in patients who appear healthy, plaque toxicity is reduced